British Association for the Advancement of Science

Ninety-Fourth Year---Toronto Meeting

GUIDE BOOK
OF THE
WESTERN EXCURSION

Toronto, 1924

UNIVERSITY OF TORONTO PRESS

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ITINERARY FOR WESTERN EXCURSION OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

TORONTO TO VANCOUVER

Via Canadian National and Timiskaming and Northern Ontario Railways

Lv. Toronto, Ont. (Union Station)	7.25 p.m.	E.T	Sunday, Aug. 17
Ar. North Bay, Ont	4.40 a.m.	"	Monday, Aug. 18
Lv. North Bay, Ont	5.10 a.m.	"	" " "
Ar. Cobalt, Ont	9.00 a.m.	"	" " "
Lv. Cobalt, Ont	1.00 p.m.	"	" " "
Ar. Swastika, Ont	3.30 p.m.	"	" " "
Lv. Swastika, Ont	9.30 p.m.	"	" " "
Ar. Timmins, Ont	1.00 a.m.	"	Tuesday, Aug. 19
Lv. Timmins, Ont	12.30 p.m.	"	" " "
Ar. Iroquois Falls, Ont	2.30 p.m.	"	" " "
Lv. Iroquois Falls, Ont	5.30 p.m.	"	" " "
Ar. Cochrane, Ont	7.00 p.m.	"	" " "
Lv. Cochrane, Ont	7.20 p.m.	"	" " "
Ar. Nakina, Ont	3.55 a.m.	"	Wednesday, Aug. 20
Lv. Nakina, Ont	3.55 a.m.	"	" " "
Ar. Armstrong, Ont	7.25 a.m.	"	" " "
Lv. Armstrong, Ont	6.45 a.m.	C.T	" " "
Ar. Winnipeg, Man	7.25 p.m.	"	" " "
Lv. Winnipeg, Man	10.20 p.m.	"	Thursday, Aug. 21
Ar. Saskatoon, Sask	1.00 p.m.	M.T	Friday, Aug. 22
Lv. Saskatoon, Sask	10.00 p.m.	"	" " "
Ar. Edmonton, Alta	9.00 a.m.	"	Saturday, Aug. 23
Lv. Edmonton, Alta	10.10 p.m.	"	" " "
Ar. Jasper, Alta	7.30 a.m.	"	Sunday, Aug. 24
Lv. Jasper, Alta	11.00 a.m.	P.T	" " "
Ar. Vancouver, B.C.	9.00 a.m.	"	Monday, Aug. 25

For Monday, a programme has been arranged by the city of Vancouver, which provides for seeing the City, the University of British Columbia (new buildings), the saw-mills, salmon canneries and other industries, Vancouver Harbour, Capilano Canyon, etc.

On Tuesday, there will be an excursion up the fiord of Howe Sound, stopping at Britannia Mines, etc.

Automobiles will be provided for excursionists who desire to visit Boundary Bay.

From Vancouver, excursions will be possible to Victoria by the Canadian Pacific day boat, leaving at 10.30 a.m., Monday or by the Canadian Pacific night boat, leaving at 11.45 p.m., Monday. Passengers on the night boat may occupy their staterooms at 10 p.m.

Returning from Victoria, excursionists may return by the Canadian Pacific night boat, leaving Victoria at 11.45 p.m., Monday or by the Canadian Pacific day boat, leaving at 2.15 p.m., Tuesday.

Excursionists may leave for Nanaimo by Canadian Pacific boats, leaving at 10.00 a.m., 1 p.m. or 5.30 p.m., Monday.

The return trip may be made by boats leaving Nanaimo at 5.00 p.m., Monday or 7.00 a.m. or 2.15 p.m., Tuesday.

VANCOUVER TO TORONTO

Via Canadian Pacific Railway

*Lv. Vancouver	2.15 a.m.	P.T.	.....	Wednesday,	Aug.	27
Lv. North Bend	6.55 a.m.	"	....	"	"	"
†Lv. Kamloops	12.30 noon	"	....	"	"	"
Lv. Revelstoke	5.40 p.m.	"	....	"	"	"
Ar. Glacier	8.05 p.m.	"	....	"	"	"
Lv. Glacier	8.00 a.m.	"	.....	Thursday,	Aug.	28
Ar. Field	12.00 noon	"	....	"	"	"
Lv. Field	1.15 p.m.	M.T.	....	"	"	"
Ar. Lake Louise	3.00 p.m.	"	....	"	"	"
Lv. Lake Louise	5.50 a.m.	"	.....	Friday,	Aug.	29
Ar. Banff	7.00 a.m.	"	.....	"	"	"
Lv. Banff	11.35 a.m.	"	.....	"	"	"
Ar. Calgary	3.00 p.m.	"	.....	"	"	"
Lv. Calgary	6.40 p.m.	"	.....	"	"	"
Ar. Swift Current	5.30 a.m.	"	.....	Saturday,	Aug.	30
Lv. Swift Current	5.40 a.m.	"	.....	"	"	"
Ar. Regina	10.40 a.m.	"	.....	"	"	"
Lv. Regina	1.40 p.m.	"	.....	"	"	"
Ar. Broadview	4.20 p.m.	"	.....	"	"	"
Lv. Broadview	5.30 p.m.	C.T.	.....	"	"	"
Ar. Winnipeg	1.00 a.m.	"	.....	Sunday,	Aug.	31
Lv. Winnipeg	1.30 a.m.	"	.....	"	"	"
Ar. Fort William	1.00 p.m.	"	.....	Monday,	Sept.	1
Lv. Port Arthur	6.00 a.m.	"	.....	Tuesday,	Sept.	2
Ar. Sudbury	5.00 a.m.	"	.....	Wednesday,	Sept.	3
*†Lv. Sudbury	9.00 p.m.	"	....	"	"	"
Ar. Toronto	6.00 a.m.	"	.....	Thursday,	Sept.	4

*Unless arrangements can be made for a special boat to leave at a later hour, those who visit Victoria must return to Vancouver by the day boat, leaving Victoria at 2.15 p.m., Tuesday.

†Half an hour to be spent at some point to be selected later in the dry belt between Lytton and Kamloops.

*†Members wishing to travel direct from Sudbury to Montreal can make use of No. 2 train (Imperial Limited) of the normal schedule.

NOTE

In compiling this Guide Book, the principal aim has been to supply an informative statement respecting the localities which are to be visited by the Excursion, supplemented by certain pertinent data respecting the country traversed by it.

To enable the excursionists to determine their position with reference to any locality mentioned in the Guide Book, the mileages, as painted on the mile-posts, have been added in the first column and in certain references in the text. Data respecting the mileage from the starting-point or from an intermediate point can be obtained either by reference to the Railway Company's time-tables or by adding the mileages together.

Except on the line between Toronto and North Bay and on that between Winnipeg and Edmonton, all mileages on the mile-posts are measured from the **eastern** end of the division upon which the traveller is journeying. The average division is from 130 to 135 miles long. Between Toronto and North Bay and between Winnipeg and Edmonton, the mileages are measured from Toronto and Winnipeg, respectively.

Unless otherwise specified, the altitudes refer to elevation of railway track opposite the station.

British Association for the Advancement of Science

WESTERN EXCURSION

AUGUST 17th to SEPTEMBER 4th, 1924

Toronto to Vancouver

via

CANADIAN NATIONAL RAILWAY

and return via

CANADIAN PACIFIC RAILWAY

TORONTO TO COBALT

Mileage	Altitude		
0.0	254	**Toronto**	Leaving the shores of lake Ontario
4.6	415	**Davenport**	(mean elevation 246.2), the line rapidly
7.5	576	**Downsview**	ascends till it reaches the water-parting
14.0	630	**Concord**	between the Humber and Holland rivers,
18.0	813	**Maple**	four miles north of King station and 26.3
22.4	956	**King**	miles from Toronto, elevation 1002 feet.
29.7	884	**Aurora**	Thence it descends the valley of the Holland
34.0	770	**Newmarket**	to lake Simcoe (718 feet).

From Toronto to a point three miles north of King the country is underlain by the shales and sandstones of the Lorraine (Dundas) formation and, from the last-named to a point two miles north of Newmarket, by the Utica shales.

From near Newmarket to the north end of lake St. John—near Longford station—the country is underlain by limestones of Trenton, Black River and Lowville age. At lake St. John the line crosses the southern limit of the great Archæan plateau and the traveller traverses this great series of formations from that point to the vicinity of Winnipeg.

The country traversed between Toronto and Longford is practically all under cultivation, mixed farming and dairying predominating. Beyond Longford the country furnishes in the aggregate a large area of arable land but, with the exception of the vicinity of lake Nipissing, very large continuous areas are not encountered till the, so-called, Clay Belt is crossed on the Timiskaming and Northern Ontario railway.

37.6	742	**Holland Landing**	Between Toronto and Holland Landing,
41.2	724	**Bradford**	37.6 miles, the line is approximately parallel
51.6	769	**Lefroy**	to the old portage road from lake Ontario
57.2	879	**Craigvale**	to lake Simcoe (area, 300 square miles;
62.7	734	**Allandale**	altitude 717 ft.). In April, 1825, nearly a
64.0	726	**Barrie**	century ago, Sir John Franklin crossed by
69.5	817	**Shanty Bay**	this route from York (now Toronto) to
74.1	789	**Oro**	Holland Landing, thence by boat down the
77.7	780	**Hawkestone**	Holland river and across lake Simcoe and
80.2	813	**Carthew**	proceeded to the Arctic ocean on his second and most successful expedition.

Mileage	Altitude		
			In 1615, Champlain passed through lakes Couchiching and Simcoe and descended the Trent river to lake Ontario—the first white man to explore this region. The "narrows" between the two lakes was traversed by Champlain and is crossed by the railway two miles east of Orillia.
86.0	**723**	**Orillia**	North-west of lake Simcoe lies "Huronia," the site of early Jesuit missions. Here, in 1649, the death-knell of the Huron nation struck and the Hurons, as a nation, ceased to exist.
88.2	**726**	**Atherley**	
92.5	**739**	**Rama**	
93.5	**733**	**Longford**	
98.5	**727**	**Washago**	
100.1	**728**	**Severn**	To avoid repetition, a description of the Archæan plateau—which applies, in a general way, to the line between Longford and Anola, 23 miles east of Winnipeg—is inserted below:
105.9	**747**	**Kilworthy**	

The Archæan plateau is traversed from Longford (93.5 miles) northward. It is composed of very ancient crystalline rocks and includes an area of over 2,000,000 square miles, or more than one-half that of the total area of Canada. While, in proportion to its size, it contributes little to the fertile areas of the country it comprises, in the aggregate, a considerable amount of land which is either cultivated or susceptible of cultivation. In the southern parts it carries forests of great value and its mineral resources are of great importance.

It constitutes, moreover, a gathering ground for many large and almost innumerable rivers and streams, which in the sources of power they offer in their descent to the adjacent lower lands, are of greater and more permanent value to the industries of Canada than an extensive coal-field. Particularly notable from this point of view is the long series of available water-powers which runs westward to the vicinity of the Rocky mountains, coincident with the southern border of the plateau.

Although designated a plateau, this term is only applicable in a very general way. Its average elevation in the vicinity of the route traversed by the excursion ranges from 1,000 to 1,500 feet. It is notably greater than that of the adjacent lands, and is maintained with considerable regularity, but its surface is everywhere hummocky or undulating.

The striking features of the Archæan plateau are innumerable lakes, large and small, with intervening wooded, rocky elevations. The rivers and lakes are everywhere well stocked with fish, while deer and moose abound. Thus, as the region can be entered without difficulty, it has become a much favoured resort for sportsmen.

112.0	**815**	**Gravenhurst**	Gravenhurst is the chief gateway of the beautiful lake-district of Muskoka, one of the most delightful of the summer resorts of the continent. The region contains numerous lakes and rivers.
122.2	**812**	**Bracebridge**	
126.9	**952**	**Falkenburg**	
135.1	**1036**	**Utterson**	
145.9	**951**	**Huntsville**	Huntsville is the gateway to the Lake
155.4	**1070**	**Novar**	

Mileage	Altitude		
161.0	1082	**Scotia**	of Bays district, celebrated for its scenery
162.9	1038	**Emsdale**	and excellent trout fishing.
166.6	983	**Katrine**	North Bay, with a population of 10,692
170.9	971	**Burks Falls**	is Ontario's newest city. It is situated in
182.6	1100	**Sundridge**	a thriving mining and agricultural district
188.4	1158	**South River**	and is an important railway centre, being
199.6	1027	**Trout Creek**	on the main line of both the Canadian Pacific
207.1	855	**Powassen**	and National railways. It is also the
219.1	670	**Callander**	southern terminus of the Timiskaming and
227.2	691	**North Bay**	Northern Ontario railway.
0.0		(**C.N. station**)	It is situated on the shores of lake Nipissing (area, 330 sq. miles; altitude 641 feet). Until roads from Toronto to lake Simcoe and from lake Simcoe to Georgian bay, combined with steamboat service, cheapened the cost of transportation, the traveller and freight from Montreal to the West were transported by the canoe-route which followed the Ottawa and Mattawa rivers, lake Nipissing and French river to lake Huron.
8.7	909	**Feronia**	At lake Nipissing we again intersect the
13.5	1055	**Widdifield**	route followed by Champlain in 1615 on
18.1	1262	**Mulock**	his adventurous journey to lake Ontario
27.3	1166	**Tomiko**	and the Iroquois country.
33.9	1019	**Riddle**	For over two centuries, these waters
39.8	1053	**Diver**	saw the fur-trader and voyageur making his
55.5	1014	**Redwater**	way westward with his goods for the fur
63.4	1049	**Doherty**	trade or returning laden with the valuable
71.8	986	**Timagami**	peltries of half a continent.

Timiskaming and Northern Ontario Railway

(The Ontario Government Railway)

NORTH BAY TO COCHRANE

83.0	1035	**Rib Lake**	Leaving North Bay the line rapidly
89.4	1066	**Johnson**	ascends to the plateau, reaching an elevation
94.1	920	**Latchford**	of 1262 feet at a point two miles north of Mulock. Timagami station is at the eastern end of lake Timagami ("deep water") (962 feet). Although only 90 square miles in area, the shore-line of its numerous arms and bays aggregates hundreds of miles. The area surrounding the lake is heavily timbered with virgin Norway (red) pine. It lies in the Timagami Forest Reserve, a tract of 6,000 square miles which has been segregated as a forest and game preserve.

COBALT

102.8	969	**Cobalt**	Thirty-one miles beyond Timagami we reach Cobalt, the centre of one of the most famous silver-mining regions of modern times.

Discovered during the building of the railway in 1903, it was soon proved by comparatively little work that Cobalt was a "poor man's camp". One of the first operators, for instance,

extracted ore having a value of $250,000 at a total cost of $2,500.

In the earlier years of mining there were no refining plants, in North America at least, that could economically treat the Cobalt ores. Owing to the unusual and complex character of the ores there was waste of other constituents in extracting the silver, there being present, in addition to the previous metal, arsenic, cobalt and nickel in important quantities.

Since then, plants capable of refining all the constituents of the ore have been erected in Ontario, the processes employed being either improvements on those hitherto used or invented especially for these ores.

The chief object in building the Timiskaming and Northern Ontario railway was the development of agricultural areas at the head of lake Timiskaming, to the north of Cobalt. It was also felt that the railway would increase the value of the timber lands through which it passed, but the most sanguine advocates of the construction of the railway did not dream of the mining development to which the construction of the road has led.

In 1904, the year in which the first shipments were made, Cobalt produced 159 tons of ore carrying 5.34 per cent, or 1,309 ounces of silver, per ton. In 1905 the shipments, 2,114 tons, averaged 3.90 per cent, or 1,139 ounces of silver per ton. In 1912, 30,243,859 ounces of silver, valued at $17,408,935, were produced.

Up to the end of 1923 Cobalt had produced silver valued at $227,700,000; Cobalt silver-mining companies had paid dividends aggregating $89,542,054 and had produced cobalt valued at $12,400,000.

In 1911 the cost of production per ounce of silver was: at the Crown Reserve 10.76 cents; at the Coniagas, 8.8; at the Nipissing, 13.95; and at the Kerr Lake, 14.69.

From 1904 to the end of 1923 about 343,895,780 ounces of silver have been obtained from the mines of the Cobalt and adjacent areas. A large quantity of cobalt and arsenic have also been produced, together with lesser quantities of nickel and copper. Owing to the fact that the mines did not always receive payment for certain of these metals, which were sometimes lost in treating the ores, it is not possible to give accurate statistics as to production.

The ore deposits are in rocks that are classified as of Precambrian age, and are believed to owe their origin to igneous intrusions. At Cobalt the intrusive rock described below is quartz-diabase.

RELATIONS OF THE ROCKS

KEEWATIN.—The oldest series known in the region is called the Keewatin. It consists for the greater part of basic volcanic rocks, now represented by schists and greenstones, together with more acid varieties such as quartz-porphyry. Associated with these rocks is considerable sedimentary material, consisting of schistose greywacké, jaspilyte, or iron formation, and crystalline limestone, which is, however, not seen in large exposures in any of the three mining areas.

LAURENTIAN GRANITE AND GNEISS.—The rocks next younger than the Keewatin are granite and gneiss. That there were granites older than the Timiskaming sediments is proved by the fact that the conglomerates of the latter frequently contain pebbles and boulders of a light-coloured or grey variety of these rocks. There is doubt, however, about the true nature of certain unconformities that have been described between the Timiskaming and the so-called Laurentian in part of the region.

TIMISKAMING.—After the intrusion of the Laurentian into the Keewatin, there was a prolonged period of erosion, during which a thick series of sediments consisting of conglomerate, greywacké and other rocks was deposited. To this series, in the Cobalt and Porcupine areas, the name Timiskaming has been given. It is known in other areas to the north, south and west of Cobalt, and appears to be represented at Sudbury by what Dr. Coleman has called the Sudbury series.

ALGOMAN (LORRAIN) GRANITE.—After the deposition of the Timiskaming sediments an intrusion of granite, characteristically pink in colour, took place. This granite, which occupies large areas, is known as Algoman. The relations of this granite to both the older and younger rocks are clearly shown at Cobalt. The granite, with associated quartz-porphyry, that gave rise to the gold deposits at Porcupine, appears to be of the same age.

COBALT SERIES.—The period of erosion that succeeded the intrusion of the Algoman granite gave rise to the conglomerate and other rocks known as the Cobalt series. Good exposures of these rocks are to be seen at Cobalt and along the railway to the south and to the north. At Porcupine only small exposures are found. The Ramsay Lake conglomerate of Sudbury appears to be of the same age.

In the Sudbury area there are also other sediments that have been variously classified as regards their age relations.

NIPISSING DIABASE AND SUDBURY NORITE.—Succeeding the deposition of the Cobalt series came the intrusion of the quartz-diabase which gave rise to the silver deposits of Cobalt. This intrusive is known as the Nipissing diabase. The Sudbury norite, with which are genetically connected the nickel-copper deposits, is similar in chemical composition and appears to be of the same age.

PALÆOZOIC ROCKS.—To the north and east of Cobalt, limestone, with basal conglomerate and sandstone, of Palæozoic age, occurs as outliers on the Precambrian.

With the exception of deposits of glacial and recent age no rocks younger than the Precambrian are found in the vicinity of Sudbury or Porcupine.

Mileage	Altitude	
107.4	**765**	**Haileybury**
112.6	**639**	**New Liskeard**
118.4	**630**	**Uno Park**
124.4	**719**	**Thornloe**
128.6	**815**	**Earlton Jct.**
134.9	**728**	**Heaslip**
138.5	**679**	**Englehart**
0.0		

Between Haileybury (107.4 miles) and New Liskeard (112.6 miles) the line runs near lake Timiskaming, an expansion of the Ottawa river, 67 miles long and with a maximum width of 5 miles. In the early days of the colony, the most advantageous canoe-route from Montreal to James bay followed the Ottawa and Abitibi rivers, and it was by this route that De Troyes made

Mileage	Altitude	
		his way northward in 1686 to capture the posts which the Hudson's Bay Company had established on the shores of James bay—Rupert established 1667; Moose, 1671; and Albany, 1679.
4.8	706	**Wawbewawa**
7.7	779	**Krugerdorf**
12.5	879	**Mindoka**
20.9	1031	**Dane**
26.0	1006	**Swastika**

Near Haileybury the line enters the "Clay Belt" and, from this point northward, it traverses a fertile farming country except where the rock outcrops near the water-parting between the St. Lawrence and Hudson bay. Excellent farms, brought under cultivation during the last fifteen years, are to be seen along the railway.

At Swastika (26 miles from Englehart and 166 miles from North Bay) we leave the railway for the Kirkland Lake gold-field. The Kirkland Lake branch has been constructed to Kirkland Lake village and beyond.

KIRKLAND LAKE

The Kirkland Lake area has now become an important gold producer. The rocks are similar to those at Porcupine but gold occurs under somewhat different conditions. Intruding the Timiskaming sediments are various stocks, dikes and sills of Algoman syenite, lamprophyre, feldspar porphyry and felsite, different facies of one magma intruded in the order of decreasing basicity. The cooling of the intrusive magma was probably accompanied by much shrinkage and faulting along east-west zones in the porphyry and adjacent rocks in planes roughly parallel to the long axes of the intrusions. Through these fractures were deposited the gold-bearing silicious solutions representing the end product of the Algoman intrusions. Porphyry and syenite are the most abundant rocks along the main shear and most of the ore deposits are in these rocks; however, ore occurs in all the other rocks along the path of the shear, with the exception of two diabase dikes which are later than the ore bodies and may be of Keweenawan age. Ore is rarely found in lamprophyre.

The ore occurs at frequent intervals along one major fracture $2\frac{1}{4}$ miles in length with a strike of N. 70° E., and a dip of from 89° to 85° to the south, occasionally flattening to 50°. The mines which adjoin one another along this main shearing, from west to east, are as follows: Kirkland Lake, Teck-Hughes, Lake Shore, Wright-Hargreaves, Sylvanite, and Tough-Oakes. In addition to the main fracture there are important branch veins and parallel fractures in a zone 500 feet or more in width.

In 1923, the mines in the Kirkland Lake field produced gold and silver valued at $2,693,633.

The four mines in the western half of the area have followed the main zone almost continuously by underground workings for $1\frac{1}{2}$ miles. In the eastern part of the area the vein-bearing zone is over half a mile in width; the main ore-bearing fracture has not been definitely recognized in this eastern section owing to the

Mileage Altitude

irregularities of the veins, faulting, drift overburden and insufficient underground work.

The main fracture zone contains two prominent fault planes, called foot-wall and hanging-wall, which are from a few feet to 40 feet or more apart, the area between being much disturbed with minor faults and slips. The ore occurs over the whole width between the principal faults or near one wall or the other and, in places, beyond the recognizable fault planes or so-called vein boundaries.

The ore at all the mines along the main shear is identical, and occurs as irregular shoots from 30 feet to several hundreds of feet in length, separated by zones of somewhat similar-looking material which may be barren or low in grade. The richer type of ore usually contains lenses of bluish, brecciated quartz, the fractures being filled with varying quantities of calcite, dark quartz, dolomite, chlorite, sericite, iron pyrites, gold tellurides, molybdenite, chalcopyrite and, occasionally, some galena, zinc blende, and graphite. Frequently the quantity of quartz in the ore deposit becomes relatively small, probably ten per cent., as compared with the red mineralized porphyry. Again, minute cracks carrying molybdenite, gold, tellurides and a little quartz, extend through the silicified, fractured, red porphyry, giving a good mill-rock.

The ore minerals are native gold, with the tellurides calaverite ($Au\ Te_2$), kalgoorlite (a telluride of gold, silver and mercury), and petzite ($2\ (Ag_3, Au)_2\ Te$). Other tellurides present are altaite (Pb Te), which is the most common and usually indicates high-grade ore since it is always accompanied by visible gold; coloradoite (Hg Te); melonite ($Ni\ Te_3$). The minerals present in the ores suggest that they are not high temperature deposits, but that they were formed at considerable depth and exposed by erosion.

The six mines, three of which are from 1,000 to 1,150 feet deep, are developing one vein or lode system, having a total length of $2\frac{1}{4}$ miles.

KIRKLAND LAKE TO PORCUPINE

29.5 1008 Kenogami Lake
44.2 1033 Bourke
56.2 944 Ramore
66.4 861 Matheson

Three miles beyond Swastika the line turns northward and traverses a comparatively level country at an altitude of 1000 to 1050 feet. At 39 miles the line crosses the water-parting between the waters of the St. Lawrence and of Hudson bay at an altitude of 1043 feet.

79.3 920 Monteith

At Monteith there is a Government demonstration farm, a school for the training of returned soldiers who are taking up farming.

From Matheson, steamboats on the Black river furnish transportation to the Abitibi river.

Mileage	Altitude		
85.9	**944**	**Porquis**	At Porquis junction (86 miles from Englehart), the excursion train leaves the main line of the Timiskaming and Northern Ontario railway for Timmins (33 miles from Porquis) in the Porcupine gold field.
0.0			
10.0	**916**	**Connaught**	Between the 8th and 13th miles from Porquis the line follows the shore of Frederick House lake. The name of the lake commemorates a post built by the Hudson's Bay Company on the west shore of the lake, the Governor and Committee of the company ordering that it be so named "in honour of His Majesty's second son."
24.0	**945**	**Porcupine**	
26.6	**922**	**South Porcupine**	
31.6	**1034**	**Schumacher**	
33.1	**1029**	**Timmins**	

Peishkachagami lake is six miles above Frederick House lake. Here, in 1673, the French built Fort St. Germain to divert the trade of Moose Factory, the Hudson's Bay Company's post on James bay. Apparently, this was the first post built by the French in the Hudson Bay basin.

Until the discovery of the much easier route by way of lac des Quinze and Abitibi lake, the French followed the canoe-route by way of the Montreal and Frederick House rivers.

PORCUPINE

The Porcupine gold area is drained by the Mattagami and Frederick House rivers. Power for operating the mines is derived from hydro-electric installations on northern Ontario rivers.

In the summer of 1909 attention was attracted to the area by the discovery of spectacular gold showings on claims which, later, became the Hollinger and Dome mines. The milling plants of the area have produced, up to the end of 1923, a total of $113,651,229, being 85.5 per cent of the total gold production of the province. During 1923 the production, including exchange, had a value of $17,646,595; this figure includes $92,533 in silver. The leading properties are the Hollinger, McIntyre, Dome, and Vipond, while active development and mining are being carried on at several others. The gold mines of Northern Ontario are producing at the rate of $25,000,000 per annum.

Up to the end of 1923 the mines of Ontario had produced gold valued at $128,400,000 and had paid dividends aggregating $33,641,978.

Geology

The rock formations belong to the Precambrian portion of the earth's crust. Of these there is a great preponderance of ancient lavas of Keewatin age. The lavas, varying in composition from basalt to rhyolite, are profoundly metamorphosed, but they still retain in many places well-recognized volcanic characteristics such as amygdules, spherules, pillow structures, ropy and scoriaceous surfaces. The lava flows are now mostly tilted on end, and the structure in the central part of the area is that of a synclinorium. With the lavas there is banded iron formation and agglomerate.

Resting unconformably on the Keewatin lavas there is a sedimentary series of conglomerate and greywacké slate, now very much deformed like the Keewatin,

and called the Timiskaming series. Both series of rocks occur in easterly pitching folds in part of the area.

Intruded into the older complex of schistose rocks from an easterly direction there are stocks and dikes of acid to intermediate rocks of a porphyritic character which are classed with the Algoman. These rocks are usually light grey in colour and frequently contain conspicuous phenocrysts of quartz and sometimes bleached feldspars. The intrusions are believed to have formed shear zones in the volcanic and sedimentary rocks which became the locus for the mineralized solutions which followed from the same magma from which the porphyries were derived.

Carbonization of all these rocks has been intense in many parts of the area. The carbonate containing some iron has been oxidized at the surface, giving the rocks a rusty appearance. It is from these rusted zones that most of the ore deposits are recognized at the surface.

In parts of the area there are masses of serpentine from some of which asbestos has been mined.

Intruding all the rocks named are dikes of massive quartz or olivine diabase which, beyond being utilized for road material, have little significance.

Ore Deposits

The principal ore deposits occur in altered volcanic or sedimentary rocks near intrusions of quartz-porphyry. The Hollinger and McIntyre deposits are in the volcanic schists, whereas most of the Dome production has come from the conglomerate and greywacké of the Timiskaming series. The deposits have a strike nearly N.E. and S.W. but are very irregular in occurrence. They consist of mineralized schist with stringers or large lenses of quartz, which frequently enclose strips of schist. The quartz in the deposits is extremely irregular, so that each successive round in drifting in the veins displays a greatly varying distribution of quartz and schist. Often lenses of ore follow each other "en échelon" in arrangement, being offset to the left. In the Hollinger veins the quartz averages about 40 per cent. of the total ore milled. Individual veins or lodes at the Hollinger and McIntyre may have a length of 1500 feet, but much of the ore is obtained in lenses having a length of a few hundred feet. Lodes may vary from 4 to 40 feet in stoping width. Most of the ore at the Hollinger and McIntyre mines is obtained in veins having a distribution relative to several porphyry masses, the eastern rake of which determines the location of the ore-shoots at various levels.

The Dome deposits, while mixtures of quartz and schist, are structurally different from the Hollinger and McIntyre lodes, due to the rock association. Pitching anticlinal and synclinal structures in the Keewatin and Timiskaming rocks, together with intrusions of quartz-porphyry, have produced conditions favourable for ore deposits of peculiar shapes. The Timiskaming sediments are wrapped around a core of Keewatin lavas which strikes N. 60° E. and pitches 40° easterly. On the south side of the Keewatin there is a deep trough of sediments which is intruded on its south margin by porphyry. Along the crest line of the Keewatin core and in the body of sediments on the south side are various ore-bodies. The deposits vary from 15 to 150 feet in width with lengths of 60 to 600 feet. Certain deposits have been followed vertically for 800 feet. Over 30 distinct ore-shoots have been encountered in the mine workings. Ore has been mined in the Timiskaming sediments, Keewatin volcanics, and Algoman

porphyry, the great volume of ore being derived from the sediments. The ore carries on the average from 10 to 15 per cent of quartz and 6 per cent of sulphides.

No porphyry intrusions are observed in the workings at the Vipond mine, which lies to the south of the Hollinger, but this rock outcrops on the Porcupine Crown property adjacent to the west, where development indicated an eastern pitch to the porphyry which crosses to the Vipond at depth.

Minerals of the Ore Deposits

The deposits were formed at a period subsequent to the intrusion of the porphyry, the magmatic solutions being supplied by a deeper part of the parent magma. The earliest of the minerals is quartz of pegmatitic origin, showing coarse granular texture and gas and liquid inclusions. Feldspar frequently accompanies the quartz. Spurr has called the quartz injection "vein-dikes" to signify their magmatic origin. With the early quartz is the mineral scheelite in small quantities. The primary quartz is much brecciated and cemented by later quartz and carbonate of varied composition. In the brecciated areas occur gold, pyrite, copper pyrites, and other sulphides.

By far the most abundant sulphide is iron pyrites which occurs mostly in the schist adjacent to the quartz masses. Generally it is well crystallized in small cubes. Massive pyrite occurs with the quartz. Sparingly but commonly recognized are copper pyrites, galena, zinc blende, and arsenopyrite. Pyrrhotite is abundant in some of the ore from the Dome mine, but it occurs sparingly in the Pearl Lake section.

Tourmaline, a high-temperature mineral, is also abundant in some Dome ore and occurs in other parts of the area. Axinite and fouqueite haye been reported in some veins near Timmins. Tellurides of varied composition are occasionally observed in the ores.

The schist ores of the Hollinger-McIntyre vein-system are usually light grey to black in colour; where carbonate is abundant shades of grey are common. Microscopically, the schist ores show quartz, carbonate, sericite, leucoxene, pyrite, and sometimes feldspar and chlorite in varying proportions. Analyses have indicated an increase in potash over soda in the mineralized rock, as compared with the normal altered volcanic rock, being due to replacement by hot ascending alkaline solutions.

Development

The deepest mine workings are at the McIntyre mine, shafts being down 2,500 feet and lateral development being carried on at 2,375 feet. The Hollinger lateral development has been carried to the 1400-foot level. At the Dome mine lateral workings are down to the 13th level, or 1,600 feet. At several other properties workings have been carried to the 1000-foot level.

During 1923 the Hollinger mine produced $10,622,262 from 1,366,352 tons of ore with an average value of $7.77; the McIntyre mine produced $2,583,336 from 291,428 tons, a recovery of $8.86 per ton.

The Dome mine, during 1923, milled 399,800 tons and $4,405,199 were produced, the recovery being $11.01 per ton.

The Hollinger treats approximately 5,000 tons; the McIntyre 1,000 and the Dome 1,200 tons per day.

Total production of the Porcupine field in 1923 was $17,646,595.

IROQUOIS FALLS

Mileage	Altitude		
0.0	944	**Porquis**	Returning to Porquis, we reach Iroquois
7.5	905	**Iroquois Falls**	Falls (7.5 miles from Porquis; altitude 905 ft.) on the Abitibi river. At this point the Abitibi Power and Paper Company operates the largest newsprint mill on the continent.

It has seven paper machines. Two of these machines are the largest thus far manufactured. Each machine makes a sheet of paper 18 ft. 5 inches wide at the rate of nearly 700 feet per minute.

The mill has a daily capacity of 500 tons of newsprint, 20 tons of wrapper paper, 135 tons of ground-wood pulp and 45 tons of sulphite pulp. Total, 700 tons.

200,000 cords of pulpwood are used per year. The limits aggregate 1,000,000 acres.

The company operates 16 miles of main line railway and five to twelve miles of branch lines. Efficiency in rail operation reduces to a minimum the amount of pulpwood in storage and obviates the necessity of carrying large quantities of supplies and reserve equipment in connection with the forest operations.

A nursery within the limits yields 3,000,000 seedlings annually and experimental work is being carried on to determine the commercial species best adapted to the conditions under which the company is operating.

The company has power developments on the Abitibi river at Iroquois falls and at Twin falls, 41 miles distant. The total turbine installation at Iroquois falls is 28,000 horse-power. There are ten Holyoke double runner turbines of 2,000 h.p., or a total of 20,000 h.p., direct connected to the wood-pulp grinders and four similar turbines, or a total of 8,000 h.p., direct connected to electric generators. The Twin Falls plant provides a reserve of 6,000 horse-power.

The mill employs 1,100 men and, in the winter, about 2,000 men are employed in the woods. Annual payroll is about $3,000,000.

IROQUOIS FALLS TO WINNIPEG

90.3	1005	**Nellie Lake**	From Porquis to Cochrane (23 miles), the
98.5	914	**Holland**	line traverses a country containing numerous
113.8	909	**Cochrane**	small lakes and rivers.
0.0			

Canadian National Railway

Cochrane is the junction of the Timiskaming and Northern Ontario railway with the Canadian National railway from Quebec to Winnipeg. The T. and N. O. Ry. has been built to Island Falls, 43 miles north of Cochrane and, eventually, will be extended to James bay.

Cochrane has a population of about 3,500. It is the business, industrial, and railway centre of the northern portion of the clay-belt in Ontario. The country along the Canadian National

Mileage Altitude

railway between Cochrane and Hearst, about 125 miles, is opened for homesteading.

From Cochrane to Winnipeg, 777 miles, the train follows the Quebec-Winnipeg air line of the Canadian National railway.

Between Cochrane and Opemisha, 260 miles, the line traverses the "clay-belt". From Opemisha to a point about 25 miles east of Winnipeg, it crosses the Archæan plateau in a country of low relief.

West of Cochrane the line crosses many large streams which offer numerous sites for the development of water-power. The Frederick House is crossed 6.5 miles west of Cochrane; the Buskega at 10.5 miles and the Driftwood at 20.3 miles. One mile west of Smoothrock Falls station the line crosses the Mattagami river (altitude of water 739 ft.).

8.4	878	**Buskegau**
17.3	895	**Driftwood**
30.3	788	**Smoothrock Falls**
41.5	795	**Strickland**

At this point the Mattagami Pulp and Paper Company operates a pulp mill with a capacity of 150 tons of sulphite pulp per day. At the Smoothrock falls, their hydro-electric plant develops 10,000 horse-power. When required, additional power may be obtained from Island falls and Yellow falls on the Mattagami, eight and ten miles, respectively, south of the railway. The Company's timber limits aggregate 900 square miles, and it is estimated that they will yield about 3,000,000 cords of spruce pulpwood.

49.7	743	**Fauquier**

The valleys of the Mattagami and Groundhog rivers, in the vicinity of Jacksonboro and Fauquier, respectively, are being settled by the New Ontario Colonization Company. An experimental farm has been established at Fauquier.

69.4	711	**Kapuskasing**

At Kapuskasing the Ontario Government has built a modern town and there is also a large pulp mill employing two hundred men, operated by the Spruce Falls Company, which produces daily 120 tons of sulphite pulp. Power is generated on the Kapuskasing river, a branch of the Mattagami river, about 115 miles long.

91.2	741	**Opasatika**
106.1	766	**Macbey**
110.0	747	**Mattice**
119.6	813	**Omo**

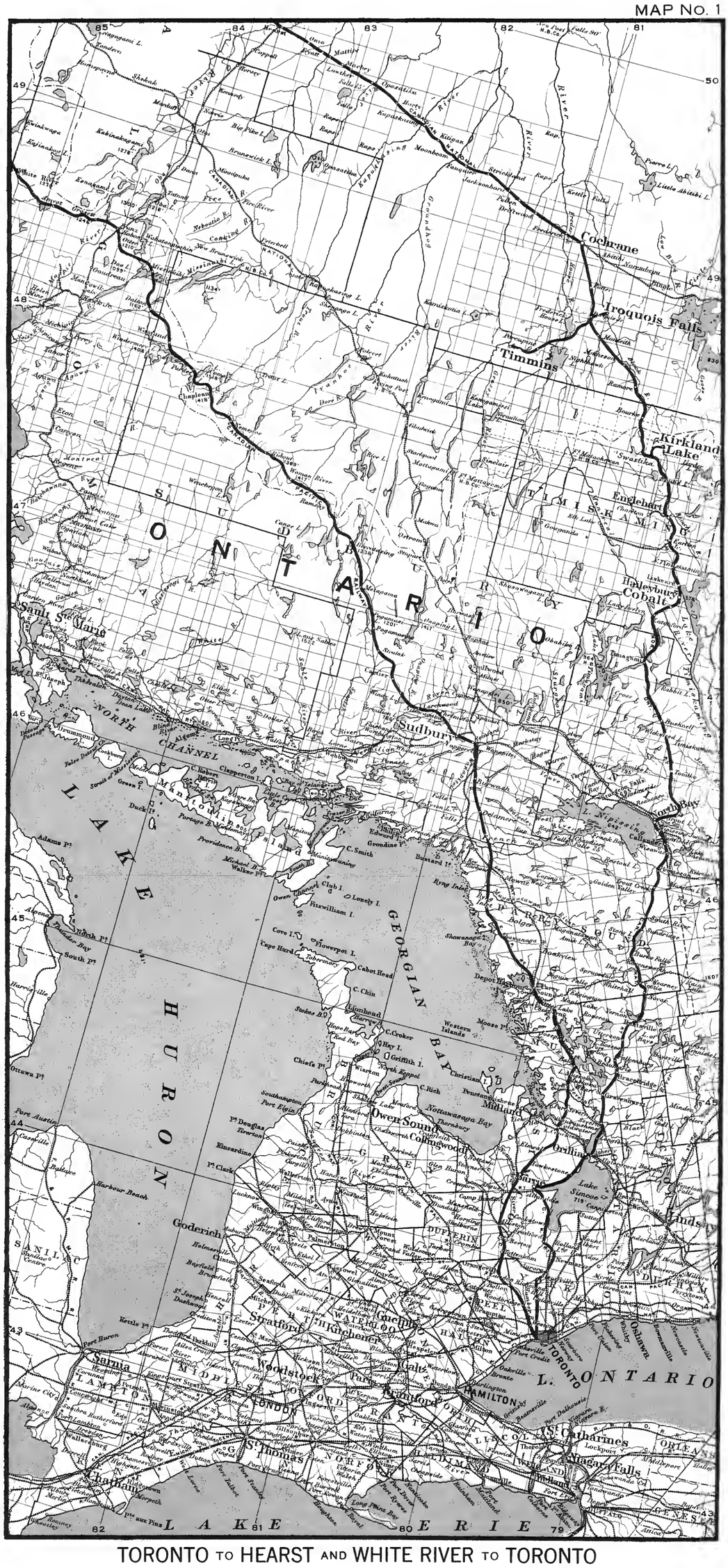
The Dominion Government has established an Experimental Farm at Kapuskasing of 1,000 acres. The soil is of the finest quality, the land gently undulating, with very little need of draining.

At Mattice the line crosses the Missinaibi river. The canoe-route from Michipicoten post, on lake Superior to Moose Factory, on James bay, follows the Michipicoten, Missinaibi, and Moose rivers.

129.1	803	**Hearst**
0.0		

Hearst is a divisional point on the Canadian National railway and is also the northern terminus of the Algoma Central

MAP No. 1



TORONTO TO HEARST AND WHITE RIVER TO TORONTO

Mileage	Altitude		
12.6	812	**Penhall**	and Hudson Bay railway, which runs southward to Sault Ste. Marie.
22.4	806	**Kabina**	
35.4	757	**Bertram**	Between Hearst and Grant the line passes through a forested country crossing numerous tributaries of the Albany river.
50.0	756	**Nagagami**	
63.9	686	**Savoff**	
76.0	577	**Pagwa River**	At the crossing (75.8 miles) of the Pagwachuan river, a tributary of the Kenogami river, the line reaches its lowest altitude in the Hudson Bay drainage basin (water, 505 ft.; rail, 572 ft.).
93.4	725	**Flintdale**	
104.5	858	**Ogahalla**	
125.1	1008	**Grant**	
139.5	1021	**Nakina**	Nakina is a railway divisional point and junction with the Long Lake "cut-off" which connects the National Transcontinental line with what was, formerly, the main line of the Canadian Northern Railway.
0.0			

From the Pagwachuan River crossing the line ascends steadily to the height-of-land—the water-parting between Hudson bay and the St. Lawrence—which is reached at 57.7 miles (altitude 1,130 ft.).

23.9	1054	**Kowkash**	Gold discoveries have been made in the country west of Nakina, particularly in the vicinity of Kowkash and Tashota.
45.5	1072	**Tashota**	
64.1	1091	**Minataree**	
82.3	967	**Ferland**	Near Ferland and Willet stations the line passes within two miles of lake Nipigon (area, 1,730 square miles; altitude, 850 ft.).
88.7	919	**Willet**	

The Nipigon Forest reserve, with an area of 7,300 square miles, includes the lake and a large area surrounding it. Lake Nipigon is one of the most beautiful lakes in Ontario and is famous for its fishing.

112.3	1118	**Armstrong**	Armstrong is a railway divisional point. Here we enter the Central Time belt and watches are put back one hour. From Armstrong to Sioux Lookout the line traverses a typical Archæan country of low relief and studded with lakes innumerable.
0.0			
13.9	1258	**Pascopee**	
21.1	1263	**Collins**	
38.9	1346	**Jacobs**	
55.9	1358	**Allanwater**	One-half mile west of Pascopee station the line re-crosses the height-of-land at an elevation of 1,271 feet, and from that point to beyond Edmonton it traverses the Hudson Bay drainage basin.

78.7	1424	**Bucke**	Bucke, 78.7 miles from Armstrong, is the highest station on the line between Toronto and Winnipeg.
100.5	1318	**Ycliff**	
116.0	1228	**Smith**	
132.7	1211	**Superior Jct.**	Sioux Lookout is a divisional point and has a population of 1,127. From it a branch line runs to Fort William and Port Arthur, the two great grain ports on lake Superior. It is situated on the shore of an expansion of the English river.
139.1	1197	**Sioux Lookout**	
0.0			

Descending the English river from Sioux Lookout about 22 miles, lac Seul (area, 392 square miles; altitude, 1,153 feet) is

Mileage	Altitude		
			reached. The great highway of the Indian and fur-trader, in pre-railway days from lake Winnipeg to James bay, followed the Winnipeg, English, and Albany rivers and traversed lac Seul.
20.8	1254	**Webster**	Until the French traders established themselves on the Winnipeg waters, the furs of the Great plains and adjacent country were carried to Fort Albany and Fort Nelson by way of this route and by the Nelson river.
39.5	1326	**Millidge**	
57.9	1348	**Hunter**	
74.7	1148	**Quibell**	
90.2	1240	**Canyon**	
106.1	1292	**Jones**	From Sioux Lookout to Brereton the line traverses a country that is well described by the Indian name "Nibigami" (country of lakes). Near Canyon station (90.2 miles), the line follows the south shores of the beautiful Canon lake for ten miles.
123.2	1082	**Redditt**	
0.0			
14.5	1066	**Minaki**	
30.1	1101	**Malachi**	
36.2	1136	**White**	Just east of Minaki (14.5 miles) the railway crosses the Winnipeg river. Minaki Inn is operated by the Canadian National railway and has accommodation for 350 guests. There are numerous summer cottages owned by citizens of Winnipeg and other cities and towns of Manitoba.
51.7	1110	**Dott**	
73.8	940	**Elma**	
88.8	902	**Hazel**	
			Verendrye descended the Winnipeg river in 1732 and established Fort Maurepas near its debouchement into lake Winnipeg. For nearly a century and a half the voyageur, the trader, the explorer and the Indian passed up, or down, this stream—part of the great highway from eastern Canada to the prairies and the Pacific and Arctic oceans.
106.2	843	**Anola**	At Anola the line leaves the forested area and enters the prairies. It crosses the Red river at 126.7 miles (low water, 730; rail, 773) and enters Winnipeg.
128.9	772	**Winnipeg**	
0.0			

PROVINCE OF MANITOBA

The Precambrian area of the Canadian shield extends into the eastern portion of Manitoba from the lake of the Woods north-westwardly skirting the eastern shore of lake Winnipeg and thence to the western boundary of the province. Gradually widening in area to the north these rocks include an area of about 144,000 square miles.

Along the western edge of the Precambrian is a broad belt of nearly horizontal Palæozoic strata. These are succeeded to the west by Mesozoic and these, in turn, by Tertiary.

An enormous lake of glacial origin, called "lake Agassiz," once occupied the valley of the Red river and the territory to the north. The fine-grained black sediment deposited on the bottom of this extinct lake now forms the fertile land of Manitoba and the West. The fertility of the Prairie Provinces is due in part to the mineral constituents of the soil and in part to the great accumulation of nitrogenous organic matter, the remains of ages of vegetable growth.

For nearly 900 miles the plain extends westward, rising in a series of three steppes from a height of 750 feet above sea-level to 3,000 feet near the Rocky mountains. These steppes are scarcely observed from the train. Rivers have cut deep and narrow valleys in the plain. In the southern part these rivers flow eastwardly to the lakes of Manitoba and to Hudson bay; in the northern parts of the plain they drain into the Mackenzie River system emptying into the Arctic ocean. A line drawn from Winnipeg to Edmonton and thence in a southerly direction to the Rocky mountains would mark the limit of the open prairie country. North of this line in the three Prairie Provinces trees begin to appear and the forested area prevails. The total mineral production of the provinces in 1922 was valued at $2,258,942.

Agriculture is the basic occupation. The hard wheat of Manitoba is famous for quality and abundance. Manitoba's agricultural possibilities have as yet reached only partial development. The increase of population has caused the rapid development of manufactures in the province. The water-powers of the province are estimated to produce at ordinary minimum flow 3,270,491 horse-power. At the beginning of 1923 only 134,025 horse-power had been developed. The area of Manitoba is 251,832 square miles, of which 19,906 square miles are water area. The population in 1921 was 610,118, an increase in ten years of more than 34 per cent. Lakes Winnipeg, Winnipegosis, Manitoba, and South Indian, comprising nearly 15,000 square miles, are the source of valuable commercial fisheries.

WINNIPEG

The capital, Winnipeg, a city of 179,087 population (1921 census) is situated at the confluence of the Red and Assiniboine rivers. It is the third city in Canada in population. In 1870 it was a village of 200 inhabitants. As the gateway of the great west, Winnipeg is the commercial focus of the plains. It is the most important railway centre in the west, all transcontinental lines passing through the city and many branches radiating to the United States and to the Canadian West. All trade from the east and the west enters its portals. It is the largest grain market in the British Empire and is the wholesale distributing centre for the West.

For many years the Hudson's Bay Company maintained a fortified post called Fort Garry upon the site of which Winnipeg now stands. A portion of the old fort has been preserved. The famous historical Red River settlement was established by Lord Selkirk near the present city of Winnipeg. A grant of 116,000 square miles of land in the Red River valley had been made to him by the Hudson's Bay Company, in what afterwards proved to be the most fertile soil in Canada. Lower Fort Garry, built by the company on the banks of the Red river and 20 miles north of the city, is a picturesque relic.

Winnipeg possesses one of the largest water-supply systems of the continent. The water, which is exceedingly pure, is brought from Shoal lake, a distance of 90 miles, through a conduit, the capacity of which is 100,000,000 gallons per day. The system was constructed at a cost of $60,000,000.

Hydro-electric energy is generated by a municipal plant at Point du Bois on the Winnipeg river, 78 miles distant. The new units now being installed will increase the capacity from 67,100 horse-power to 88,000 h.p. The ultimate capacity will be 102,000 h.p. The Pinawa plant of the Winnipeg Electric Railway

Company has a capacity of 37,800 h.p. The transmission line is 65 miles long. The new development of the Manitoba Power Company at Great Falls, Winnipeg river, will have an initial installation of 56,000 h.p. with an ultimate designed capacity of 168,000 h.p. A transmission line 15 miles long will connect it with the Winnipeg Electric Railway's transmission line.

Winnipeg is the most cosmopolitan city of the West, representing, in its population, all countries of Europe. There are many buildings of note in the city, especially the new Parliament Buildings. The University of Manitoba, with six affiliated colleges, is situated in Winnipeg. The number of students in 1922 was 2,426.

St. Boniface, on the opposite side of Red River, is a separate municipality, but is practically a suburb of Winnipeg. It is the headquarters of the Roman Catholic Church in Central and Western Canada. Flour mills operating in the town are said to be the largest in the British Empire. The inhabitants number 12,821, of whom the majority are French.

WINNIPEG TO EDMONTON

From Winnipeg the train crosses the flat and apparently limitless prairie which stretches as far as the eye can see. In harvest time these boundless acres with their vast crops of wheat present a singularly impressive sight to the traveller. So well organized are the forces of the harvesters and the railways that, within a few days after cutting has begun, nought is to be seen but stubble, the wheat is pouring into the elevators, and trains one-half mile long are hurrying it to Fort William and Port Arthur, the great lake-ports on lake Superior.

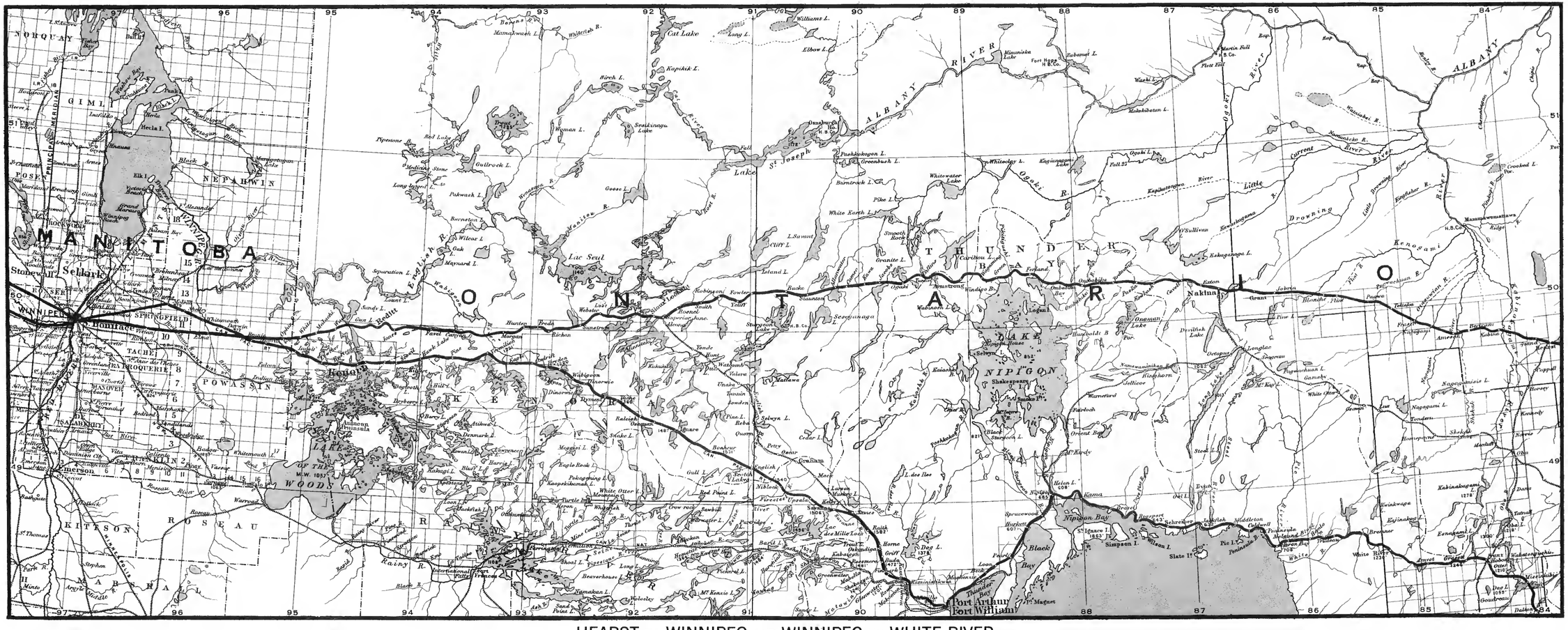
The remarkable fertility of the prairie soil is due to the large proportion of vegetable matter forming humus. Countless generations of plant life have produced a soil of remarkable depth in which the sand and clay have become incorporated with the humus, which is nature's store-house for nitrogen. In decay of the humus, valuable potash, phosphoric acid, and lime are liberated.

Of equal importance with its chemical nature is the physical condition of the soil in its capacity to hold moisture. The prairie soil, during the growing season, retains amounts of water in excess of soils less rich in organic matter though favoured with heavier precipitation. The subsoil of clay is nearly impervious to water and prevents its rapid dissipation, as in land where there is subsurface drainage.

The rate of nitrification during the vegetative period affects the growth of crops, and while temperature and moisture largely control this process the amounts of nitrates formed must be materially affected by the quantity of food supply which the micro-organisms find in partially decomposed matter. Nitrogen, the most potent plant food, exists in abundance in this soil. Except when affected by insufficient precipitation, very rapid nitrification takes place in the spring and early summer months, consequent upon the large water content, and the high diurnal temperature. Long days of sunlight and sufficient rainfall combine to hasten the process of growth. There is no waste of leaching during the autumn and winter months, as in lands of milder climate. Frost comes quickly and locks up the stores of plant food for use in the following spring and summer.

Mileage	Altitude		
0.0	**772**	**Winnipeg**	Portage la Prairie, on the Assiniboine
7.0	**772**	**Pacific Junc.**	river, recalls the early days of the explorer

MAP No. 2



HEARST TO WINNIPEG AND WINNIPEG TO WHITE RIVER

Mileage	Altitude		
14.4	**785**	**West Winnipeg**	Verendrye and his sons who, in their
22.2	**791**	**Cabot**	search for the "Western Sea," first explored
30.5	**794**	**North Elie**	the southern prairies and, in 1738, erected
54.3	**856**	**Portage la Prairie**	Fort La Reine where Portage la Prairie now
59.8	**855**	**Arona**	stands. As the name indicates, the fort was
71.0	**940**	**Caye**	built on the Assiniboine at the southern end
82.3	**994**	**Dock**	of the portage across the prairies from lake
91.4	**1133**	**Firdale**	Manitoba. From lake Manitoba, canoe-
106.8	**1277**	**Harte**	routes lead to lake Winnipegosis, lake
121.7	**1438**	**Justice**	Winnipeg, and the Nelson and Saskatchewan rivers. The city has a population of 6,766 and is a thriving grain market and industrial centre. Four transcontinental lines pass through the town.

Between Arona and Firdale, 32 miles, the line crosses nine beaches of the glacial lake Agassiz, and rises from 855 feet to 1,133. These beaches are evidenced in the sandhills and stunted vegetation.

About one mile west of Ingelow the line crosses the shore-line of lake Agassiz at its highest stage and traverses the second prairie steppe.

142.2	**1571**	**Rivers**	Rivers, the next divisional point, is in
158.4	**1647**	**Oakner**	the valley of Minnedosa river and in the centre of a famous wheat-growing district.
170.8	**1562**	**Quadra**	Beyond Quadra the line commences the
185.9	**1372**	**Uno**	descent into the valley of the Assiniboine
203.5	**1301**	**Lazare**	river. At 173.4 miles it crosses the shore-line of the glacial "lake Souris."

At 204.6 miles it crosses the Assiniboine river; thence, it follows the valley of the Qu'Appelle river and, by a long side-hill grade, climbs out of the river valley. At 214 miles it re-crosses the shore-line of the glacial lake Souris at an approximate elevation of 1,500 feet.

The boundary between Manitoba and Saskatchewan is crossed at 212.7 miles, nearly 4 miles west of Victor.

PROVINCE OF SASKATCHEWAN

The province of Saskatchewan includes an area of 251,700 square miles, of which 8,892 square miles represent the water area, principally confined to large lakes in the northern half of the province.

The population in 1921 was 757,510. The increase in twenty years was 666,231, nearly 730 per cent. This rapid development was due to its remarkably fertile soil and the extraordinary influx of immigrants. Saskatchewan leads the Dominion in the production of wheat. The yield of wheat in 1920 was 113,135,300 bushels, and in 1923 it was 252,622,000 bushels. The total value of its wheat harvest for 1923 was 51 per cent of the total value of all the wheat produced in Canada for that year. It is estimated that not more than one-sixth of the cultivable area of the province is under cultivation. It is notable that the wheat crop of Saskatchewan in 1921 exceeded by $18,000,000 the value of the output of gold from the Klondike from its discovery to date.

Mileage	Altitude		
224.7	**1620**	**Spy Hill**	From Cutarm to beyond Melville, a
233.9	**1654**	**Cutarm**	distance of 47 miles, the line runs across the
251.8	**1733**	**Atwater**	open prairie in a straight line and slowly
265.4	**1733**	**Waldron**	rises from 1,650 feet to 1,820 feet, or only 4 feet per mile.
279.3	**1812**	**Melville**	Melville is a divisional point and
291.4	**1984**	**Fenwood**	junction with branches to Regina and
307.7	**2175**	**Hubbard**	Yorkton and the upper waters of the
326.1	**2219**	**Kelliher**	Assiniboine.
351.8	**2113**	**Punnichy**	West of Ituna the line reaches its
371.6	**1845**	**Semans**	highest elevation east of Saskatoon, 2,227
385.5	**1716**	**Nokomis**	feet, at 317.1 miles.
408.3	**1784**	**Watrous**	From Hubbard to beyond Punnichy, a
422.3	**1717**	**Young**	distance of 44 miles, the country is studded
453.7	**1730**	**Clavet**	with scores of small lakes.

At Watrous, a railway divisional point, we enter the Mountain Time belt and watches are put back one hour. Beyond Watrous the line gradually descends to the valley of the South Saskatchewan river, which is crossed at 468.3 miles (elevation of water, 1,553 feet; rail, 1,624 feet).

SASKATOON

470.4 **1589** **Saskatoon**

Thirty years ago a few "shacks" indicated the site of the present city of Saskatoon. In 1901 it was an incorporated village with a population of 113. In 1903 it was a town and, in 1906, it was incorporated as a city with a reported population of 5,000. In 1921 the census showed 25,739 inhabitants.

Saskatoon is the distributing centre of 47,000 square miles of territory. To serve this territory there are over fifty wholesale houses. It also has several important manufacturing industries, among them being a large plant for the production of breakfast foods; flour mills, with a capacity of 2,250 barrels a day; woodworking and metal-plating plants; machine shops and foundries. Annual value of its manufactured products is nearly $11,000,000. There is a Dominion Government interior terminal elevator with a capacity of 3,500,000 bushels of grain. The city owns its electric light and power plant and its street railway, water, and sewerage systems.

Saskatoon is an educational centre. It is the seat of the University of Saskatchewan, the Provincial Agricultural College, and has a collegiate institute, a normal school, and thirteen public schools.

An important railway centre, it is served by the transcontinental line and by branches of the Canadian National railways to Calgary, Regina and Prince Albert. It is also on the Canadian Pacific line from Winnipeg to Edmonton.

Mileage	Altitude	
474.7	1658	**Farley**
491.8	1711	**Asquith**
501.4	1755	**Kinley**
515.1	1986	**Mead**
526.7	2154	**Biggar**
535.3	2125	**Oban**
556.7	2225	**Cavell**
569.4	2163	**Scott**
584.6	2092	**Unity**
604.0	1987	**Winter**
623.2	2008	**Artland**
633.6	2060	**Chauvin**
648.0	2119	**Edgerton**
666.8	2222	**Wainwright**
684.5	2244	**Irma**
698.8	2297	**Kinsella**
732.6	2253	**Holden**
741.4	2273	**Ryley**
752.9	2294	**Tofield**
766.7	2433	**Cooking Lake**
776.8	2340	**Ardrossan**
785.8	2155	**Clover Bar**

At Eaglehill Creek crossing (499.3 miles), the line commences to climb to the third prairie steppe, which is reached at Biggar.

Biggar is a divisional point and junction with branches running to Battleford and Loverna.

Beyond Biggar the line traverses an area that is studded with numerous lakes and "sloughs," the elevation ranging from 1,925 feet near Unity to 2,276 feet, 2.7 miles east of Wainwright.

Wainwright is a railway divisional point. About a mile west of the town is the famous Buffalo park. It contains the world's largest herd of buffalo and includes an area of 100,000 acres. Commencing in 1907, with a herd of 706 head, purchased in Montana, there are now upwards of 6,000.

Beyond Wainwright the line descends to the valley of Battle river, which is crossed by a viaduct one mile long and 181 feet above low water.

At Viking there are natural gas wells, with an aggregate capacity of 40 million cubic feet per day. Cooking Lake is a popular summer resort for the people of Edmonton and vicinity.

Three miles west of Clover Bar station the line crosses the North Saskatchewan river (788.0 miles) on a bridge 137 feet above the water.

EDMONTON

792.9	2185	**Edmonton**
0.0		

Edmonton, the capital of the Province of Alberta, occupies a commanding position on the high banks of the Saskatchewan river. Its geographical position was recognized by the North West Company—the sometime great rivals of the Hudson's Bay Company—and, in 1808, they built "new" Fort Augustus on the site now occupied by the Parliament buildings. It was called "new" Fort Augustus to distinguish it from "old" Fort Augustus, near the mouth of Sturgeon river, built in 1794. Near "old" Fort Augustus the Hudson's Bay Company had a post called Fort Edmonton. After the union of the two companies in 1821, the "new" fort was called Fort Edmonton.

Even before the advent of the railway, Edmonton was the centre from which trappers and fur-traders began their journey into the northern wilds, while the mighty North Saskatchewan served as a highway to and from all parts of the great West. Twenty-three years ago it had a population of 2,626. In 1905 the

Mileage Altitude

population was 10,000; when the census was taken in 1921 it was nearly 59,000.

Edmonton is an important distributing centre and has more than one hundred wholesale houses. It is also a manufacturing centre, the output of its factories having an annual value of nearly $31,500,000. The three plants of its important industry, meat packing, employ 1,200 hands. Edmonton is one of the most important butter-making centres in Western Canada, the annual output of butter exceeding 7,000,000 pounds, or over half the total of the entire province. Edmonton is underlain by coal seams, and in the city and vicinity there are over thirty coal mines.

Just as Edmonton was in pioneer days the centre from which trails diverged, to-day it is a railway centre. It is on the main line of the transcontinental systems, while the Canadian Pacific and Canadian National railways have eight branch lines diverging from the city.

Edmonton has thirty-six well-appointed public schools, two high schools, seven colleges, and an excellently equipped technical school. It is also the site of the University of Alberta, which occupies a magnificent position on the banks of the Saskatchewan overlooking the Parliament Buildings. The city owns and operates all its public utilities, such as street railway, telephones, electric light and power and water services. There are also two municipal hospitals.

EDMONTON TO VANCOUVER

23.9	2323	**Stony Plain**
44.2	2384	**Wabamun**
57.9	2440	**Gainford**
66.3	2571	**Entwistle**
77.4	2623	**Junkins**
99.5	2737	**Niton**
109.7	2786	**Peers**
129.5	2985	**Edson**
0.0		
9.4	3117	**Bickerdike**
19.6	3271	**Galloway**
35.6	3562	**Obed**

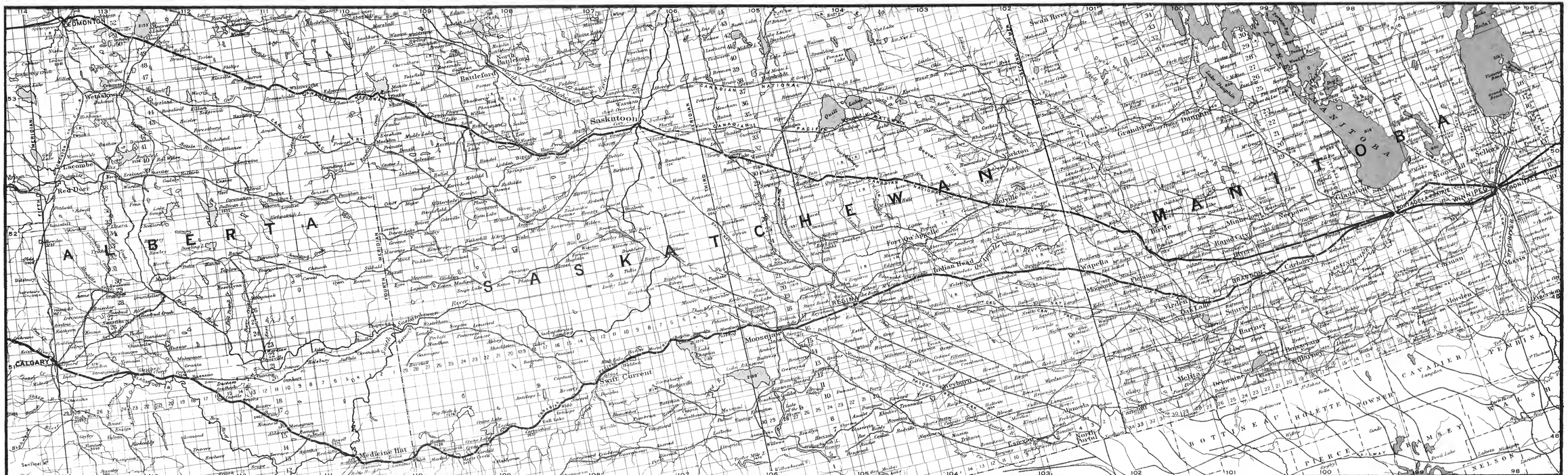
About 30 miles west of Edmonton the line leaves the prairie country proper and enters the semi-forested area that occupies a belt of country to the east of the foothills. Wabamun lake (44 miles) is a favourite summer resort for citizens of Edmonton.

The height-of-land between Hudson bay and the Arctic ocean is crossed near Entwistle (2,571 feet). At 67.8 miles the line crosses the Pembina river on a bridge 206 feet high and 900 feet long. At 121 miles the line crosses Wolf creek on a bridge 125 feet high.

Edson is a railway divisional point. At Bickerdike (9.2 miles) a branch line leads to the coal mines at Mountain Park and Lovett. From Edson the line follows in or near the valley of the McLeod river to 28.0 miles; thence, it climbs steadily to the water-parting between the McLeod and Athabaska (altitude 3,570 feet; 35.1 miles from Edson).

From the summit the line descends 354 feet, on a long side-hill grade, to the Athabaska River crossing (60.5 miles; rail 3,216 feet and 50 feet above low water). Thence, it follows the north bank of the Athabaska to Jasper and beyond.

MAP No. 3



WINNIPEG TO EDMONTON AND CALGARY TO WINNIPEG

Mileage	Altitude	
61.8	3216	**Entrance**
71.8	3265	**Brule**
91.2	3290	**Snaring**
106.4	3470	**Jasper**
0.0		

From Solomon creek (67.5 miles) to Bedson tunnel (75.5 miles) the line follows the shore of Brûlé lake. At 68.0 miles, it is opposite the site of the original Jasper House, built by the North West Company probably between 1812 and 1814. Prior to Father de Smet's visit in 1846 it had been moved to the west shore of Jasper lake, nearly opposite the 86-mile post. The name is a punning reference to the name of the clerk in charge, Jasper Howse, or Hawes.

The principal peaks seen after passing Miette station are: Roche Miette, 7,377; Roche Ronde, 7,016; Cinquefort, 7,412; Roche Jacques, 8,540; Mt. Gargoyle, 8,834.

A few traces remain of Henry House, a North West Company post opposite the mouth of the Maligne river (101 miles). It was probably built about 1810.

JASPER

Of the various parks and reserves maintained by the Canadian Government in the Rockies and adjoining territory, the two most celebrated are Jasper park and the Rocky Mountains park. The Jasper National park has an area of 4,400 square miles, and is noted for its beautiful scenery. It extends along the railway for about 80 miles. Not only is the Park a perpetual game preserve and forest reservation, but, within its limits, abound beautiful lakes of wonderful colour, deep forests of primeval trees, and snow-capped peaks whence limitless views may be had.

At Jasper travellers going west enter the Pacific Time belt and watches are set one hour earlier. Jasper is a divisional point on the railway and the headquarters of the park Superintendent.

On the shores of lac Beauvert, three miles from Jasper station, is Jasper Park lodge, operated by the Canadian National railway. There, in a well-constructed hostelry with every desirable comfort, the traveller before proceeding farther may rest and visit many places of beauty in the park. One of the peculiar charms of Jasper park is the large number of accessible mountains within easy reach. To the north of the lodge is Colin range, 8,185 to 8,815 feet; to the east are Signal (7,397 feet) and Tekarra (8,818 feet) mountains; while to the northwest stands out clear and bold Pyramid mountain (9,076 feet), noted for its wondrous colour. Several peaks within the park are of considerable altitude, some exceeding 10,000 feet. Mount Edith Cavell is 11,033 feet in height; Atlanta, 12,000; and mount Dome, 12,000. Trails and roads have been made through the forests leading to points of interest, beautiful lakes, glaciers, and superb views. Motors and horses with guides may be taken for various trips to mount Edith Cavell, to Maligne canyon, Athabaska falls, and other sights.

Just west of Jasper the line leaves the Athabaska and follows the valley of a tributary, the Miette. At 17.2 miles it crosses the height-of-land (3,713 feet) between the Arctic and Pacific watersheds, at the summit of the Yellowhead pass. This is the highest point on the main line of the Canadian National railway and the lowest crossing of the continental divide by any railway north of Mexico.

THE PROVINCE OF BRITISH COLUMBIA

The province of British Columbia comprises an area of 353,416 square miles, of which 2,439 square miles are water area. The population in 1921 was 524,582, and is chiefly confined to the southern part of the province and to Vancouver island. The climate is influenced by the warm Japan current which flows against the western shores of North America and is not affected by a cold Arctic current as in similar latitudes of the Atlantic coast. The same cause produces copious rainfall on the western slopes of the mountains. About 15,000,000 acres are estimated as the extent of the land suitable for agricultural purposes. Fruit-growing is extensively carried on in the southern valleys but agriculture is developed only to a limited extent. The main industries are lumbering, fishing, and mining. The forests of the province and the enormous size of the trees are well known. The value of the forest products in 1921 was $64,970,000. Fisheries are of great importance, including salmon, halibut, cod, and other fish. The catch for 1920 was valued at $22,329,161. Mineral resources of the province include vast coal deposits, and gold, silver, copper, lead, and zinc. For the year 1922 the total value of mineral production in the province was $39,423,962.

THE CORDILLERA

The Cordillera, in Canada, has a length of about 1,300 miles and a width of about 400 miles between the Great plains and the Pacific. The two dominant systems are the Rocky mountains on the east and the Coast mountains on the west.

The Rockies are chiefly composed of Palæozoic rocks, largely limestones. In width they seldom exceed 60 miles. The average height of the main summits is between 8,000 and 9,000 feet though many peaks exceed 11,000 feet. The highest peak, mount Robson, is 13,068 feet.

The Coast mountains constitute the main western border of the Cordillera. Beginning near the estuary of the Fraser river, they run northward with an average width of about 100 miles for upwards of 1,000 miles to Lynn canal and beyond. They are largely composed of granite with infolded masses of altered Palæozoic strata. They are not, as a rule, so rugged in outline as the Rockies, but their western side, rising from the sea, shows the full value of their elevation there, while their main summits often exceed 8,000 to 9,000 feet. On the Pacific side they include a remarkable system of fiords.

Outside the Coast mountains and in a partly submerged condition lies another range, of which Vancouver and Queen Charlotte islands are projecting ridges.

In the inland portion of British Columbia, between the Coast mountains and the Rockies, are numerous less important mountain ranges, which, while preserving a general parallelism in trend, are much less continuous. Thus, in the south, the Selkirk mountains are parallel to the Rockies and extend northward in Canada to the "great bend" of the Columbia. Immediately west of the Selkirks are the Columbia mountains which, further north, are represented by the Cariboo mountains. The highest known summit of these ranges is mount Sir Sandford, 11,590 feet, in the Selkirks.

The Interior plateau constitutes an important physical feature. Near the International boundary it is terminated southward by a coalescence of rather irregular mountains, and again to the northward, it ends about latitude 55° 30′ in another plexus of mountains without wide intervals.

Its breadth in the south is about 100 miles and its length is about 500 miles. It is convenient to speak of it as a "plateau" but its true character as a table-land is not apparent until some height has been gained above the lower valleys, where the eye can range along its level horizon lines. It is highest to the southward, but most of the great valleys traversing it are less in elevation than 3,000 feet above the sea. To the north its main area is less elevated than 3,000 feet, making its average height about 3,500 feet.

Owing to the greater precipitation on the western slopes of the dominant mountain ranges, the tree-growth is more luxuriant than on the eastern slopes. This is particularly the case in the Coast mountains.

The Interior plateau constitutes the southern part of a notably dry belt and includes wide stretches of open grass-covered hills and valleys, forming excellent cattle ranges.

Mileage	Altitude		
17.2	3713	**Alberta and British Columbia Boundary**	After crossing the summit of Yellowhead pass the line commences the descent of the Pacific slope, following the valley of a tributary of the Fraser river. From Rainbow (38.1 miles) to 45-mile post, it follows the north shore of Moose lake, a beautiful sheet of water from one-half mile to a mile and a half wide. Across the lake from Rainbow, a beautiful cascade, fed by a glacier in the Selwyn range, falls 1,000 feet down the mountain side. It was named Rockingham falls by Milton and Cheadle in 1863.
22.2	3650	**Lucerne**	
44.2	3401	**Redpass Jct.**	
54.8	3155	**Mt. Robson**	Mount Robson is the highest peak in the Canadian Rockies (13,068 feet) and is the dominating feature of Mount Robson park, a provincial forest and game preserve, 840 square miles in area. It is notable that the **highest** mountain in the Canadian Rockies and the **lowest** pass in the Rockies between Mexico and the Peace river are within a few miles of each other.

Milton and Cheadle, in their "North West Passage by Land," say: "On every side the snowy heads of mighty hills crowded around, whilst immediately behind us a giant of giants and immeasurably supreme, rose Robson's Peak. This magnificent mountain is of conical form, glacial clothed and rugged. When we first caught sight of it a shroud of mist partially enveloped the summit, but this presently rolled away, and we saw its upper portion dimmed by a necklace of light, feathery clouds, beyond which its pointed apex of ice glittering in the morning sun shot up far into the blue heaven above to a height of probably 10,000 or 15,000 feet."

The panorama of the Fraser and Grand fork, as seen from the railway, 500 feet above the valley floor, is magnificent. Mount Robson is in view for about nine miles, towering above the spectator. In all directions are rugged peaks, many of them over 10,000 feet.

Mileage	Altitude	
65.9	2818	**Jackman**
92.0	2866	**Albreda**
114.8	2304	**Pyramid**
132.9	2237	**Blue River**
0.0		

Three miles northwest of Jackman is "Tête Jaune Cache." For over a half-century this name has appeared on the maps as if it were a village or town, though the "cache" was never more than a trapper's storehouse. Although the name is now applied to a "flat" at the junction of three valleys, the actual "cache" or storehouse was situated ten miles east of it at the confluence of the Grand Fork river and the Fraser.

Near Jackman the line leaves the Fraser valley and follows the valley of McLennan river to its source. Thence, it traverses the basin of Canoe river, a tributary of the Columbia, to Albreda station, where it crosses the water-parting between the Columbia and Fraser waters to the Albreda river, a tributary of the North Thompson. Thence, it follows the valleys of the Albreda and North Thompson to Kamloops.

Blue River is a railway divisional point. About three miles south of Blue River, Milton and Cheadle, in 1863, found the "headless" Indian as narrated in their "North West Passage by Land." When published, the story was received by the reviewers with a certain amount of skepticism but, in 1872, the missing head was found "150 yards up the bank of the river." The evidence seems to indicate that one of the authors removed it to give a touch of interest to the narrative.

13.6	2079	**Messiter**
24.8	1897	**Avola**
47.1	1633	**Irvine**
61.5	1386	**Birch Island**
82.4	1286	**Boulder**
98.1	1252	**Chinook Cove**
107.3	1236	**Louis Creek**
124.7	1185	**Vinsulla**

At 12.0 miles, four miles south of Wolfenden, we reach the Porte d'Enfer rapids of the North Thompson. A huge arch once stretched across the present channel, and "has been rifted asunder, leaving a passage for the river not more than thirty feet wide." Through this passage the river rages. Lower down, where the opposing rocks are only fifteen feet apart, the river "boils and spurts up as if ejected from beneath out of an hydraulic pipe".

Below Cottonwood Flats station, the valley contracts and, between this point and the mouth of the Clearwater river, it falls nearly 500 feet. The celebrated "bunch grass"—which has no superior for horses or cattle—appears near the Clearwater and is an infallible sign that the traveller has reached a region of less precipitation. From this point to below Lytton, the line traverses the so-called "dry belt", where irrigation is required to ensure crops each and every year.

142.2	1154	**Kamloops**
0.0		
7.8	1183	**Tranquille**
25.7	1174	**Savona**
36.2	1075	**Anglesey**
48.9	992	**Ashcroft**

Kamloops is situated at the junction of the North Thompson and the South Thompson and has a population of 5,500. It is a centre of supply for a large district in the so-called, "dry belt." It was established as a fur-trading post in 1812 by the Pacific Fur Co. The first discovery of gold in

Mileage	Altitude		
74.9	742	**Spence Bridge**	British Columbia was reported from the
83.1	699	**Seddell**	Thompson river in 1856.

Below Kamloops, the line follows the valley of the Thompson river, crossing and re-crossing that stream. At Ashcroft the famous Cariboo wagon road leaves the Thompson valley and turns northward to climb to the plateau. Three miles below Ashcroft, the line enters the Black canyon, where the river has cut through 200 feet of shale and sandstone.

Spence Bridge commemorates the fact that, at this point, the Cariboo road crosses the Thompson. At Gossett are the Gladwin bluffs, cliffs of red, grey, and yellow rock.

Lytton, named after Bulwer Lytton, the famous English novelist, who was Colonial Secretary, 1858-59, is situated at the junction of the Thompson and Fraser rivers. Here, the line crosses to the west bank of the Fraser. Near Cisco, six miles below Lytton, it re-crosses and continues on the east side to New Westminster. The tremendous volume of water in the Fraser during freshets may be gauged from the fact that, at Cisco bridge, extreme high water mark is 79 feet above low water.

97.8	565	**Lytton**	Below Lytton, the line runs southward
110.2	606	**Falls Creek**	through the canyon of the Fraser, though the
125.6	453	**Boston Bar**	term is commonly confined to the portion
0.0			between Boston Bar and Yale. The peaks

of the Coast mountains tower up to the west and, to the east, the summits of the Cascade mountains flank the valley. Between a point two miles below Gorge station and Yale the Fraser descends 150 feet in 17 miles.

At Hell-gate, two miles north of Chapman, two jutting promontories compress the Fraser and force it through a narrow passage as a roaring rapid. The railway pierces the eastern promontory by a tunnel 1,320 feet long.

12.7	357	**Chapman**	Near Chapman, the towers of the old
26.7	218	**Yale**	suspension bridge whereby the Cariboo road
40.2	157	**Hope**	crossed the Fraser may still be seen and,
54.1	100	**Cheam View**	during the construction of the Canadian
65.1	52	**Rosedale**	National line, they were utilized as supports
71.8	30	**Chilliwack**	for a foot-bridge. At intervals portions of
87.4	22	**Matsqui**	the old road may be seen clinging to the
103.2	23	**Langley**	cliff and, at Jackass mountain, it was 1,500
114.9	11	**Port Mann**	feet above the river.
118.7	34	**Westminster**	Fort Yale was founded by the Hudson's
130.4	16	**Vancouver**	Bay Company in 1848, at the head of

navigation. A few years later, a route to the interior, by way of the Coquihalla river, was opened and Fort Hope was established at the mouth of this stream.

Below Hope, the railway emerges from the canyon and, turning westward, enters the fertile delta of the Fraser. The Coast mountains begins near the Fraser and run northward

for at least 1,000 miles. The Cascades continue in a southerly direction and pass into the United States.

At Langley, in 1827, the Hudson's Bay Company established their first post in the lower Fraser and, at Langley, their representatives, in 1858, transferred the government of the mainland to the Imperial Government. It was selected as the site of the first capital of British Columbia but, before the new Government buildings were commenced, it was abandoned in favour of New Westminster.

The railway crosses the Fraser river (discharge in high water 1919, 371,500 cub. ft. per second) at New Westminster, the capital of British Columbia in the early days of the province. New Westminster has a population of 14,495. It has extensive salmon canneries and large saw-mills.

From New Westminster, the line crosses the peninsula between the Fraser River and Burrard Inlet to Vancouver.

VANCOUVER

Vancouver is named after the great navigator, Captain George Vancouver, and is delightfully situated on Burrard inlet. The scenery in its vicinity is magnificent. To the north rise the peaks of the Coast mountains, to the south-east mount Baker, and across the water to the west are to be seen the mountains of Vancouver island. It is the largest city in the Province, having a population of nearly 117,000, while that of "Greater Vancouver" (which includes North Vancouver, South Vancouver, Point Grey, and other suburbs) is 225,000.

Vancouver's public buildings and offices are remarkably fine specimens of architecture, being in many cases of granite. It has finely-paved streets and splendid motor roads and bridle paths. It has an ample supply of pure water, obtained from the Capilano river and brought through a conduit laid under the inlet. An area of waste land, known as False Creek, formerly flooded by the sea, has been reclaimed, and railway terminals occupy the site.

Stanley park, reserved by the British Government for purposes of fortification, and now the property of the Dominion of Canada, is a piece of virgin forest, with magnificent "great trees" of Douglas fir, cedar, and hemlock. Mountain goat, bear, and deer are to be had in the hills along Burrard inlet, and there is splendid trout fishing in a number of streams at no great distance. Capilano canyon, a few miles across the narrows, is one of the most interesting and beautiful spots on the coast.

Vancouver is Canada's main Pacific port. In 1923, 19,694 vessels, aggregating 8,463,488 tons, entered and 19,436, aggregating 7,830,423 tons, departed. Of this shipping, 845 ocean-going vessels, aggregating 2,807,786 tons, entered and 680 vessels, aggregating 2,207,298 tons, departed.

Alberta wheat, in increasing volume, is being shipped through Vancouver to the United Kingdom via the Panama canal and across the Pacific to the Orient. In the 10 months ending June 30, 1924, 50,691,096 bushels of wheat were shipped through the port and it is anticipated that, by the end of the crop-year, August 31st, the shipments will have reached about 60,000,000 bushels.

Extensive harbour improvements are under way and a dry dock is to be constructed.

There are many important industries in Vancouver, among them being lumber and shingle mills, shipyards, fish and vegetable canneries, and a sugar refinery, its 675 factories having in 1921 an estimated output of $87,786,041.

VICTORIA

Victoria, the capital of British Columbia, was founded in 1846, and is the chief city on Vancouver island. The Parliament Building, overlooking James bay, is one of the finest examples of architecture in America. It contains fine collections of natural history, mineral, agricultural, and horticultural specimens, and is a centre of great interest to visitors. Population, according to the census of 1921, is 38,775. Population of city and suburbs, over 60,000. The city strongly resembles places in the Old World, beautiful gardens surrounding most of the homes.

Victoria has an excellent harbour, with a depth of thirty feet at low water. Lines of steamships operate from here to Seattle, Vancouver, Prince Rupert, Anyox, and Skagway. Steamers also run from here to Australia and the Orient. Ocean-going steamers alone to the number of over three thousand, with an aggregate tonnage of nearly 4,000,000 tons, enter and clear from the harbour annually, making it one of the leading ports in Canada. There are over 150 industries in the city, the principal products of which are canned fish, biscuits, furniture, machinery, lumber, carriages, soaps, and tents, the aggregate annual value of which is nearly $24,000,000. The neighbourhood supplies fish, timber, coal, and copper.

Three miles from Victoria is the excellent harbour of Esquimalt, and defended by modern fortifications. It also has a fine dry dock, and the Dominion Government is shortly to construct a still larger and more modern one there.

VICTORIA TO TORONTO via CANADIAN PACIFIC RAILWAY

Leaving Victoria, the return trip to Vancouver is made on Canadian Pacific steamship.

Mileage	Altitude		
129.0	16	**Vancouver**	From Vancouver, the line follows the shore of Burrard inlet to Port Moody and then crosses to the north bank of the Fraser river near Westminster junction. Thence, it follows near the Fraser, traversing the celebrated Fraser delta with its rich alluvial soil. Petain is the junction with the Kettle Valley railway, which crosses the Fraser at Hope (page 29) and follows the valley of the Coquihalla river. Near here, the mountains close in and the line enters the canyon of the Fraser (page 29). Between Yale and Spuzzum, the line passes through four tunnels in quick succession. Utilizing, wherever possible, the remnants of the river terraces, the railway crosses from each terrace to the next by high bridges and rock
116.5	14	**Port Moody**	
112.5	34	**Westminster Jct.**	
102.8	24	**Haney**	
87.3	27	**Mission**	
68.1	47	**Harrison Mills**	
58.9	60	**Agassiz**	
41.7	183	**Petain**	
27.1	220	**Yale**	
15.5	399	**Spuzzum**	
0.0	493	**North Bend**	
121.4			
110.7	561	**Keefer**	
94.8	693	**Lytton**	
85.5	673	**Thompson**	
72.6	774	**Spence Bridge**	

Mileage	Altitude	
60.8	860	**Spatsum**
47.2	1004	**Ashcroft**
32.0	1259	**Walhachin**
25.2	1163	**Savona**
14.6	1141	**Cherry Creek**
0.0	1160	**Kamloops**
128.8		

or earth "fills" many of them with stone retaining walls.

North Bend is a railway divisional point. A few miles below it is Hellgate canyon (page 29). Nine miles north of Keefer (101 miles), the line crosses the Fraser to the east bank, passing under the Canadian National bridge (page 29). At Lytton, it turns up the valley of the Thompson and follows the south bank of that river to Kamloops and beyond. Three miles east of Lytton, the Thompson—a bright green as compared with the muddy flood of the Fraser—flows 300 feet below the track.

Savona commemorates the name of a ferryman who, in pre-railway days, operated a ferry near the outlet of Kamloops lake. From Savona to Kamloops, the line runs near Kamloops lake for 25 miles, skirting the shores of its bays and tunnelling the mountain spurs that project into the lake.

From Kamloops (page 28), the line follows the south bank of the South Thompson to Squilax (87.8 miles), whence it climbs on a long side-hill grade to reach a cross-valley from the lower end of Shuswap lake to one of its bays, Salmon arm. From Salmon Arm station it follows the shore to Sicamous, the junction with a branch line to the Okanagan valley, one of the famous fruit-growing regions of Canada.

104.6	1151	**Pritchard**
93.7	1183	**Chase**
87.8	1288	**Squilax**
79.8	1691	**Notch Hill**
70.6	1158	**Tappen**
63.4	1158	**Salmon Arm**
52.5	1155	**Mowitch**
44.7	1154	**Sicamous**
37.8	1178	**Cambie**
28.3	1226	**Craigellachie**
24.2	1280	**Taft**
14.6	1168	**Three Valley**
8.3	1825	**Eagle Pass**
0.0	1495	**Revelstoke**
125.9		

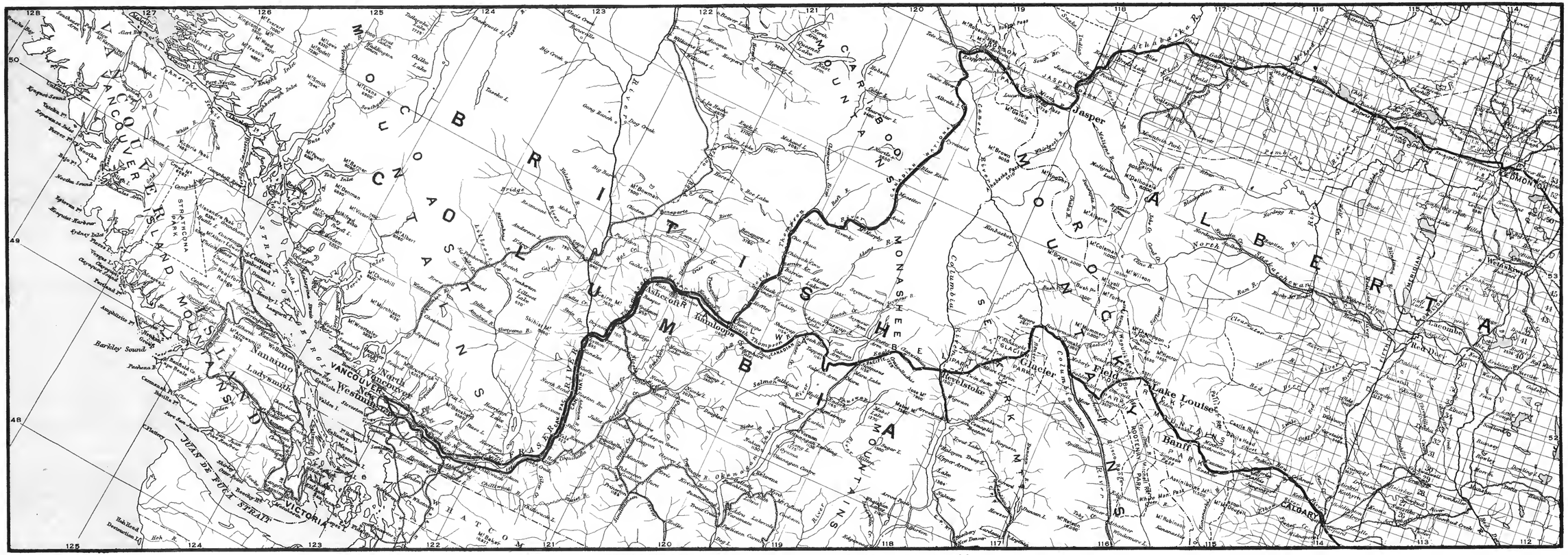
Leaving Sicamous, the railway enters the Columbia mountains and ascends the valley of Eagle river to Eagle pass. At Craigellachie, an obelisk beside the track commemorates the driving of the last spike of Canada's first transcontinental railway on 7 November, 1885. Half-mile east of Clanwilliam the railway reaches the summit of the Eagle pass, 1,825 feet, the water-parting between the waters of the Fraser and Columbia. One mile west of Revelstoke it crosses the Columbia river (water, 1,428; rail, 1,478).

Revelstoke lies near the confluence of the Columbia and Illecillewaet rivers. It is the junction with the branch line to the Arrow Lakes and Kootenay district and is surrounded by the peaks of the Columbia and Selkirk mountains. The most prominent peaks are: mount Begbie, 8,946 feet, in the southwest, and Mackenzie, 8,064 feet, and Cartier, 8,562 feet, in the southeast.

115.2	1879	**Twin Butte**
105.0	2226	**Albert Canyon**
102.3	2475	**Downie**

Leaving Revelstoke, the railway follows the valley of the Illecillewaet into the heart of the Selkirks. The name of this river is

MAP No. 4



EDMONTON TO VICTORIA AND VICTORIA TO CALGARY

Mileage	Altitude		
98.4	**2713**	**Illecillewaet**	said to be the Indian equivalent of "wait
93.5	**3094**	**Flat Creek**	a bit," an ironical reference to this
85.6	**3778**	**Glacier**	torrential stream. At Albert Canyon the river boils at the bottom of a gorge 150 feet deep and 20 feet wide. Twenty miles beyond Albert Canyon station we reach Glacier.

GLACIER

Glacier is the station for Glacier House, the centre of the finest mountain-climbing region of the Selkirk mountains. The hotel is one and one-half miles from the station and is reached by a good automobile road.

The panorama from Glacier House is magnificent. To the right of the hotel, facing the lawns, is the gleaming white Illecillewaet glacier. On the left of the glacier rises mount Sir Donald (10,808), named after the late Lord Strathcona (Sir Donald A. Smith). Farther to the left are sharp peaks: Uto (9,610), Eagle (9,353), Avalanche crest (9,387), and Macdonald (9,482). Still circling around one sees Rogers pass and the snowy Hermit range, the most prominent peaks of which are the Swiss peaks (10,505), and mount Grizzly (9,061). Again on the left, at the west end of the Hermit range, comes Cheops (8,506) and, in the foreground and far down among the trees, the Illecillewact river glistens in the valley. Circling again back towards the hotel the shoulders of Ross peak (7,718) are visible over the wooded slope of mount Abbott (8,081). Behind Ross peak and Abbott is an enormous wall of ice, the Mount Bonney glacier.

To the right of Ross, between Ross and Cheops, a glimpse is caught of the Cougar valley, where are the wonderful caves of Nakimu. To the right of the great Illecillewaet glacier is the Gothic-shaped valley of Asulkan brook, a gem of mountain beauty. The peaks going from right to left are: Afton, the sharp apex; the Rampart, an oblong wall; the Dome, a rounded rock; Castor and Pollux, two sharp spires farthest south.

The Illecillewaet glacier is exactly two miles away, and its slowly receding forefoot, with immense crevasses, is only a few hundred feet above the level of Glacier House.

An easy trail leads to Marion lake. Cascade summer house is on Avalanche crest, directly above the mountain torrent which tumbles down its green shoulder to the head of the Asulkan valley, where the ice-flow of the two main branches of the glacier meet.

The Asulkan Valley trail branches off from the main Glacier trail about a quarter-mile from the hotel and climbs up the east side of the valley to the foreFoot of Asulkan glacier, distant four miles from the hotel. There are trails by way of the Illecillewaet and by way of Rogers pass to the Nakimu caves (Nakimu being Indian for "grumbling caves"), a series of caverns, with beautiful interior marble markings, situated on the lower slopes of mount Cheops.

Leaving Glacier, the train immediately enters the Connaught tunnel, exactly 5 miles long—the longest railway tunnel in America. Prior to its construction the line ascended 552 feet higher to the summit of Rogers pass, 4,341 feet. To reach the summit the line doubled back on itself in the famous "loop" and four miles of snowsheds were required to protect the line in winter, the snowfall averaging thirty-four and one-half feet. The tunnel pierces mount Macdonald, is double- tracked, is 29 feet wide and has a clearance of 21½ feet above the rail.

Mileage	Altitude		
79.1	3512	**Connaught**	On emerging from the tunnel, the line
76.8	3504	**Stony Creek**	is nearly 1,000 feet above the Beaver river.
74.9	3328	**Cutbank**	From the western portal of Connaught
73.5	3168	**Sturdee**	tunnel, the line steadily descends, often on
68.0	2591	**Rogers**	a grade of 117 feet to the mile, and reaches
63.1	2433	**Beavermouth**	the bottom of the Beaver valley near
51.6	2580	**Donald**	Rogers. On this long side-hill grade it
41.6	2558	**Moberly**	crosses several very deep gorges. When
35.1	2583	**Golden**	constructed in 1885, the Stony Creek bridge, a wooden trestle 312 feet high, was the highest in the world, but has since been eclipsed by two other bridges.

Between Beavermouth and Golden, the railway is in the great Intermontane valley between the Rockies and Selkirks. This great valley, in Canada, extends from the International Boundary northwestward to the Peace river and beyond, and marks the western limit of the Rocky mountains.

Five miles east of Beavermouth, the railway crosses the Columbia river (water, 2,518 feet; rail, 2,560). The Columbia, one of the largest rivers of the Pacific coast, rises in a lake, nearly 100 miles south of Golden, flows northwest, then, rounding the northern extremity of the Selkirks at the "Big Bend," it flows southward to Revelstoke (page 32) and, thence, after expanding into the Upper and Lower Arrow lakes, it flows into the United States.

About a mile north of Golden and on the east side of the track is the model Swiss village of Edelweiss, erected by the Canadian Pacific for the Swiss guides whom it employs for the benefit of mountain climbers.

27.9	3009	**Glenogle**	Leaving Golden, the line turns up the
17.0	3685	**Leanchoil**	valley of the Kicking Horse river to cross
8.2	3703	**Ottertail**	the Rocky mountains. Between Golden
0.0	4075	**Field**	and the Palliser bridge (21.5 miles), the river falls 727 feet. This portion is known as the "Lower Canyon" of the Kicking Horse. In pre-railway days the pack trail climbed the mountain side till it was 1,000 feet above the river and the name for this portion of the trail, the "Golden Stairs," commemorates the numerous mules and pack-horses that were lost there.
136.6			

Just beyond Leanchoil the valley turns northward, the Ottertail range, with its towering peaks (Goodsir, 11,676; Cathedral, 10,454) flanking the eastern side of the valley.

132.4	4501	**Cathedral**	At Field, a railway divisional point, we
131.7	4578	**Lower portal, Ogden Tunnel**	enter the Mountain Time belt and watches are put forward one hour. It is the centre
130.2	4724	**Yoho**	of Yoho park, area 476 square miles. Among
129.5	4800	**Lower portal, Cathedral Tunnel**	the attractions of the park are the Takakkaw falls, Twin falls, Yoho glacier, Emerald
122.7	5331	**Stephen**	lake, etc. Surrounding Field are: mount

Mileage	Altitude		
122.2	**5338**	**Great Divide**	Stephen, 10,485; mount Burgess, 8,463;
116.6	**5050**	**Lake Louise**	mount Field, 8,545; mount Dennis, 8,326.

Leaving Field the railway climbs 1,145 feet, or nearly one-quarter of a mile, to Hector. When constructed, the maximum gradient was 4.5 per cent., or 237 feet to the mile. By the construction of a new line which makes complete circles in the "spiral tunnels" under mount Ogden and Cathedral mountain, respectively, the length of the line is doubled and the maximum grade is reduced to 2.2 per cent. or 117 feet to the mile. Mount Ogden tunnel, the lower, is 2,890 feet long and the upper, Cathedral Mountain tunnel, is 3,206 feet long.

The Kicking Horse river is a raging torrent which, in the first two miles below Hector lake, falls 690 feet.

At 122.2 miles, seven miles east of Hector, is the "Great Divide." It is the highest point on the Canadian Pacific railway, is the boundary between British Columbia and Alberta and is the water-parting between the waters of the Pacific and the Atlantic.

At this point is a granite shaft erected to the memory of Sir James Hector, the scientist of the Palliser expedition, 1857-1860, and the discoverer of the Kicking Horse pass. Near Leanchoil (page 34) he was kicked by his horse and the name of the river and pass commemorate the occurrence.

Descending Bath creek to its confluence with the Bow river brings us to Lake Louise station.

LAKE LOUISE

Lake Louise is 620 feet above Lake Louise station and is reached by means of a light gasolene railway. Turning a shoulder of the mountain we come suddenly into full view of the lake, named after Princess Louise.

This is a lake of the deepest and most exquisite colouring, ever changing, mirroring in its depths the sombre forests and cliffs that rise from its shores on either side, the gleaming white glacier and snow-crowned peaks that fill the background of the picture, and the blue sky and fleecy clouds overhead. The Chateau Lake Louise, on the shores of this beautiful lake, is operated by the Canadian Pacific railway.

The principal mountains surrounding lake Louise are (from left to right as you stand on the hotel verandah): Saddleback (7,983), Fairview (9,001), Lefroy (11,220), Victoria (11,355), Whyte (9,776), Devils Thumb (8,066), Big Beehive (7,440), Niblock (9,754), St. Piran (8,681), and Little Beehive (7,110). Victoria glacier, which shuts off the southern end of the lake, is an impressive spectacle. Along the westerly shores of the lake is a beautiful mile-and-half walk affording splendid views of these gigantic peaks.

Amongst the numerous delightful excursions from lake Louise is that to Lakes in the Clouds, two gems that nestle high up on the mountain side. The trail rises gradually to Mirror lake (6,655), and thence to lake Agnes (6,875). There are beautiful views on the way up, and the trail is excellent. A charming tea house has recently been established on the shore of lake Agnes. The trail continues around lake Agnes and up a zigzag path to the Observation House on the Big Beehive. Other charming trips are to Moraine lake, surrounded by the "Ten Peaks," 10,000 to 11,225 feet, to Paradise valley and to lake O'Hara.

Mileage	Altitude	
106.5	**4828**	**Eldon**
99.0	**4675**	**Castle Mt.**
92.9	**4592**	**Massive**
88.0	**4549**	**Sawback**
81.9	**4537**	**Banff**

Leaving Lake Louise the railway follows the Bow river through a well-forested valley. To the south may be seen, among other peaks of the Bow range, mount Temple (11,626), snow-capped, the Ten Peaks, Storm mountain (10,809), Pilot mountain (9,680) and mount Bourgeau (9,517). To the north, Castle mountain (9,030), with its battlements, rises like an ancient fortress.

Opposite Castle Mountain station is the Vermilion pass, which is traversed by the new motor highway to the Columbia river.

BANFF

Banff is the administrative headquarters of Rocky Mountains park (area, 2,751 square miles; greatest length about 100 miles). No part of the Rockies exhibits more beautiful scenery, and nowhere are features of special interest so accessible either by good roads or bridle paths.

The principal mountain ranges of the Park are the Vermilion, Kananaskis, Bourgeau, Bow, and Sawback ranges; it is drained by the Bow and Spray, Cascade and Pipestone and the Panther and Red Deer rivers. The principal lakes are Louise, Minnewanka, Spray, Kananaskis, Hector, and Bow.

Within easy walking distance is Sulphur mountain, a long wooded ridge rising to an elevation of 8,030 feet, which has an observatory on its summit and the Canadian Alpine Club's permanent club-house on the slopes. In the southern portion of the Canadian Cordillera—which includes the Rockies, Selkirks, Columbia, Coast and Cascade mountains—there are no less than 672 named mountain peaks which rise to 6,000 feet above sea level. This list includes only those peaks which bear names, and does not profess to include the innumerable mountains that have not yet been named or measured. Of these, there are 146 over 10,000 feet.

Cascade mountain (9,825), faces the town. The sharp pointed edge of mount Rundle (9,665) makes a most striking feature. Mount Edith (8,370) and Stoney Squaw (6,160) are close at hand. The Banff Springs hotel stands on a height between the falls of the Bow and the mouth of the Spray river. From it beautiful panoramas are obtained. Just below the terrace is one of Banff's three distinctive sulphur swimming pools, supplied with sulphur water piped from Sulphur mountain and averaging 90 degrees F. and possessing great curative value. The pool is a beautiful one, affording excellent swimming; and a semi-circular cold-water pool adjoins it on the crest of the hill. The other two pools are at the Upper Hot Springs, on the wooded slopes of Sulphur mountain and reached by carriage or on foot; and at the Cave and Basin, about a mile west of the bridge, where the government has erected a handsome swimming bath.

In an enclosed part about 1½ miles to the north of the town are native animals, such as buffalo, elk, moose, Rocky mountain sheep, and Rocky mountain goat. The buffalo herd, with a larger one in Wainwright park (see page 23), and the 1,000 wood buffalo on a reserve near the Slave river, comprise the sole remains of the millions of buffalo which roamed the Canadian prairies fifty years ago.

Mileage	Altitude	
79.6	4583	**Bankhead**
67.1	4296	**Canmore**
57.3	4260	**Exshaw**
52.1	4218	**Seebe**
41.6	4078	**Morley**
33.0	3896	**Radnor**
22.8	3760	**Cochrane**
9.4	3564	**Keith**
0.0	3438	**Calgary**
180.3		

Continuing the descent of the Bow valley, the train passes between the rugged peaks which flank it on both sides. At Bankhead and Canmore are the only anthracite mines in Canada. To the south of the railway are the Three Sisters (highest peak, 9,734). Guarding the entrance on south is Pigeon mountain (7,845) and, on the north, Grotto mountain (8,870). At Exshaw there is a large Portland cement mill. Between Exshaw and Seebe the railway emerges from the mountains and enters the foothills which extend to Calgary.

Hydro-electric plants on the Bow river near Seebe generate electrical energy for use in Calgary. Large ranches for live stock are to be seen in Cochrane and elsewhere through the foothill belt.

CALGARY

Calgary, population 72,000, with the exception of Vancouver, is the largest city west of Winnipeg. Founded forty years ago, it is now a flourishing industrial and agricultural centre, is well supplied with clay for brick manufacture and with building stone quarries. It is close to immense developed coal areas and large developed water-powers. It is the centre of the ranching industry and of the largest single block thus far brought under irrigation.

The business portion of the city is surrounded by hills but, from the higher portions, one can obtain beautiful views of the Rockies. Calgary is the headquarters of the Natural Resources Department of the Canadian Pacific, which administers all the Company's land, mineral and timber interests in the West. Experienced irrigation farmers who settle on the land are given twenty years for payment of the cost of the land after an initial payment of ten per cent. has been made, thus enabling the farmer to get firmly established on his land and his farm in full operation. This method established many settlers in the irrigated area.

Calgary has modern facilities, electric power, street cars, and natural gas, which is piped from Bow Island at very cheap prices for both manufacturing and domestic purposes. The city has beautiful parks and many golf courses, including a municipal course.

Mileage	Altitude	
170.1	3377	**Shepard**
159.6	3300	**Langdon**
145.5	3190	**Strathmore**
124.8	2961	**Gleichen**
116.3	2852	**Cluny**
105.8	2708	**Crowfoot**
97.6	2599	**Bassano**
80.8	2509	**Southesk**
66.8	2488	**Brooks**
53.4	2471	**Tilley**

At Strathmore the line enters an extensive irrigation block comprising some 3,000,000 acres. Canals and ditches used for irrigation are seen everywhere and irrigated farms are visible on all sides. Although the necessity for irrigation in Alberta is not so great as it is in the United States, a reliable system of irrigation in this comparatively dry belt increases the yield and ensures a crop irrespective of meteorological conditions.

Mileage	Altitude	
44.2	2439	**Kininvie**
34.9	2503	**Alderson**
25.8	2464	**Suffield**
14.5	2593	**Bowell**
5.9	2443	**Redcliff**
0.0	2180	**Medicine Hat**
147.4		

At Gleichen there is a large reservation assigned to the Blackfoot Indians. At Bassano a dam across the Bow river provides storage and control of water used in the irrigation area. By means of this dam the water level is raised 45 feet and distributed through 2,500 miles of canals and ditches.

At Brooks a notable concrete aqueduct carries the irrigation canal for two miles across a flat valley. It passes beneath the railway track by means of an inverted siphon.

Medicine Hat (population 12,000), is the site of a large clay products plant and of a flour mill with a daily capacity of nearly 5,000 barrels. It is noted for its natural gas wells which supply power for its factories and for domestic needs.

140.3	2410	**Dunmore**
125.7	2504	**Irvine**
115.2	2443	**Walsh**
97.3	2549	**Kincorth**
84.5	2506	**Maple Creek**
63.8	2525	**Crane Lake**
43.3	2648	**Carmichael**
27.3	2563	**Antelope**
0.0	2431	**Swift Current**
99.3	2377	**Waldeck**
90.1	2335	**Rush Lake**
66.5	2368	**Ernfold**
45.0	2276	**Secretan**
25.6	1987	**Mortlach**
8.2	1802	**Boharm**
0.0	1779	**Moose Jaw**
127.1	1879	**Pasqua**
116.9	1914	**Belle Plaine**
101.8	1867	**Grand Coulee**
92.4	1895	**Regina**

Between Walsh and Cummings we cross the boundary between Alberta and Saskatchewan. Wheat fields appear, the ranching country has been left behind, and we enter a good mixed farming district. Although ranching is carried on south of this section, most of the land is devoted to farming. Swift Current, with a population of 3,518, is the distributing point for merchandise throughout the surrounding country.

After leaving Swift Current the line passes over an undulating plain. Here and there the old trails and "wallows" of the buffalo may still be seen. Near Secretan we descend from the third prairie steppe—more generally known as the Missouri Coteau—to the second steppe.

Moose Jaw (population 19,285) is the centre of a rich wheat growing district and an important divisional point. In 1901 this city had only 1,558 inhabitants. It is one of the largest milling points in Saskatchewan. The value of its manufactured products in 1920 was $18,798,823. There are several branch railway lines connecting Moose Jaw with the country to the north and south.

REGINA

Regina (population 45,000) is the capital and largest city of the Province of Saskatchewan. It is one of the most important distributing points west of Winnipeg for farming machinery and farm implements, and the home of some large mail-order houses. An oil refinery has been built at a cost of two million dollars, the oil being brought from Wyoming. Regina has very handsome Parliament buildings, facing the placid Wascana lake, and has

Mileage	Altitude		

excellent exhibition buildings. It is a modern city with well-paved streets, parks, large educational institutions, splendid buildings, and numerous wholesale distributing houses and factories. It was for over forty years the headquarters of the Royal North-West Mounted Police, one of the most famous bodies of constabulary in the world, whose exploits have been so often chronicled, both in fact and in fiction, as to have become almost historic.

83.8	2022	**Pilot Butte**	From Regina eastward we still traverse the second prairie steppe. Qu'Appelle is a pretty town, noted for its trees. Twenty miles north is Fort Qu'Appelle, a trading post built before 1793. Indian Head (population 1,600) has a Dominion Government experimental farm and forestry farm.
77.1	2192	**Balgonie**	
59.4	2132	**Qu'Appelle**	
50.3	1927	**Indian Head**	
39.7	1986	**Sintaluta**	
30.8	1955	**Wolseley**	
23.0	1945	**Summerberry**	
8.1	1959	**Oakshela**	At Wolseley the Canadian Pacific has a nursery of 115 acres, where trees are grown for transplanting to prairie farms and flowers and vegetables are grown for their hotels and dining cars.
0.0	1968	**Broadview**	
130.9			

At Broadview, a railway divisional point, we enter the Central Time belt and watches are put forward one hour.

116.6	1973	**Whitewood**	East of Broadview numerous lakes and copses add to the attractiveness of a very productive district. Moosomin (population 1,500) is situated in an excellent dairying country. Three miles east of Fleming we enter Manitoba. Elkhorn has an Indian Industrial school.
102.5	1939	**Wapella**	
86.3	1892	**Moosomin**	
77.7	1799	**Fleming**	
70.4	1696	**Kirkella**	
64.1	1640	**Elkhorn**	
55.4	1587	**Hargrave**	
47.2	1451	**Virden**	Brandon (population 18,000) is situated in one of the richest agricultural and live stock districts of Manitoba. It is the commercial centre of some 300 towns and villages. It has a Dominion Government Experimental Farm and is beautifully situated on elevated ground overlooking the valley of the Assiniboine river.
32.0	1423	**Oak Lake**	
24.8	1428	**Griswold**	
8.1	1369	**Kemnay**	
0.0	1205	**Brandon**	
133.1			

127.6	1220	**Chater**	Leaving Brandon we cross the Assiniboine river (water, 1,163; rail, 1,184) and climb nearly 80 feet to Carberry. During the war Camp Hughes (114.5 miles) was the training ground for thousands of soldiers from Western Canada. Carberry is a prosperous town of 1,000 inhabitants.
121.8	1225	**Douglas**	
105.8	1262	**Carberry**	
92.9	1237	**Sidney**	
77.8	961	**McGregor**	
55.6	857	**Portage la Prairie**	
40.5	818	**Poplar Point**	
28.9	810	**Marquette**	At Douglas we cross the highest shoreline of the glacial lake Agassiz. Between Sydney and McGregor the line descends from the second prairie steppe to the first.
0.0	771	**Winnipeg**	
125.7			

Mileage	Altitude		
			For Portage la Prairie, see page 20. Between Portage la Prairie and Winnipeg we traverse the Portage plains, as level as the proverbial billiard table.
			For Winnipeg, see page 19.
106.5	795	**Hazelridge**	Leaving Winnipeg the line crosses the Red river. About 54 miles from Winnipeg we leave the prairie region and enter the great Archæan plateau (see page 6), a region of lakes and streams and of forested hills which, in the region traversed by the excursion, do not attain a height which would justify calling them mountains. One and one-half miles west of Ingolf we enter the Province of Ontario. Keewatin is practically a suburb of Kenora. It is a large flour-milling and lumbering centre.
87.8	882	**Molson**	
72.1	910	**Whitemouth**	
52.1	1057	**Rennie**	
31.3	1190	**Ingolf**	
13.9	1187	**Busteed**	
3.1	1085	**Keewatin**	
0.0	1090	**Kenora**	
146.2			
			Kenora (population 6,000), a railway divisional point, is situated at the outlet of the lake of the Woods. This lake, area 1,851 square miles, is the largest on the main line of the Canadian Pacific west of lake Superior and is of great beauty. It contains hundreds of islands and is a favourite resort of citizens of Winnipeg and other cities and towns. Kenora contains large flour-mills, lumber yards, etc.
121.4	1292	**Hawk Lake**	At Hawk Lake there are granite quarries. At Eagle River there are two beautiful waterfalls. Dryden (population 1,000) contains a large pulp and paper mill.
80.0	1191	**Eagle River**	
63.3	1224	**Dryden**	
35.2	1350	**Dyment**	
0.0	1486	**Ignace**	
147.2			Ignace is a divisional point on the railway.
			At Savanne we cross the Savanne river, which forms part of the canoe-route followed by the fur-traders between lake Superior and the West. For many years some of the boats used by the Wolseley expedition in 1870 were to be seen near the railway bridge. At Raith we cross the height-of-land between the waters of Hudson bay and the St. Lawrence. From the crossing of the Kaministikwia river (23.8 miles) we follow its valley to Fort William.
129.5	1530	**Bonheur**	
110.9	1516	**English River**	
71.3	1508	**Savanne**	
53.0	1584	**Raith**	
39.9	1477	**Buda**	
32.5	1183	**Finmark**	
23.4	1017	**Kaministiquia**	
12.8	948	**Murillo**	
0.0	616	**Fort William**	
132.9			

FORT WILLIAM AND PORT ARTHUR

The "twin cities" of Fort William (616 feet) and Port Arthur (613 feet) have a distinction that is peculiarly their own. Situated at the head of navigation on lake Superior, they form the funnel through which the huge grain crops of Western Canada find their way into the markets of the world. Together, they constitute Canada's great grain port. Hauled thither by railway cars from the West, the grain is consolidated into great bulk, transferred to lake

steamers, and carried down the Great lakes to Port McNicoll, Midland, Buffalo, and other ports. As much as 369,000,000 bushels—331,000,000 by water and 38,000,000 by rail—of grain have passed through these two cities in one year (1916). In the 10 months ended 30 June, 1924, 331,000,000 bushels—320,000,000 by water—passed through. Shipments for the year ended 31 August are estimated at 363,000,000 bushels—352,000,000 by water. The total capacity of the thirty-two great terminal elevators is in excess of 56,000,000 bushels, or the equivalent of 746 train-loads of 50 cars each. The Canadian National elevator at Port Arthur, capacity 8,000,000 bushels, is the largest thus far constructed.

Fort William (population 28,000) is situated at the mouth of the Kaministikwia River. It is on the transcontinental line of the Canadian Pacific and on the southern transcontinental line of the Canadian National railway. It is also the terminal of the Canadian Pacific Great Lakes, and other steamship services. Fort William was formerly the western headquarters of the North West Company, and was the great rendezvous of the partners, chief factors, chief traders, and clerks of the company, with the voyageurs. The first post at this point was established about 1678 by Du Lhut (Duluth). Verendrye, the French explorer, also established a post here in 1731.

Port Arthur (population 18,000) is the judicial centre for the District of Thunder Bay. It has a shipbuilding plant, pulp and paper plants, lumber mills, blast furnaces, and ore and coal docks, as well as elevators. It is a modern city with substantial buildings, hotels, wholesale houses, factories, fine hospitals and an extensive school system. A fertile country suitable for all agricultural pursuits, with large areas of lumber and pulp-wood, surrounds it.

The Twin Cities are the gateway to a vast area of almost unexplored territory of forest, lake, stream and mountain. Excellent game hunting, including moose, red deer, caribou, and brown bear, and fishing—trout, bass, maskinonge—are to be obtained. Kakabeka fall, twenty miles west of Fort William on the Kaministikwia River, is ten feet higher than Niagara, and can now be reached by a good automobile road.

Power is supplied to the Twin Cities from Kakabeka fall and from the Cameron Falls plant on the Nipigon river.

In 1868, native silver was discovered on a tiny island called Silver Islet, off Thunder cape. In fourteen days, ten men working with tongs and long-handled shovels, took out 28,073 lbs. of ore, which sold for $23,115. In all, this tiny rock produced $3,500,000 worth of silver. The minerals found in this mine were practically the same as were found at Cobalt a third of a century later. Closed down in 1884, it was reopened in 1920. In addition to taking out the silver ore in the roof of the mine, some cross-cutting was done to intercept other veins which, however, proved barren.

The $1,000,000 coal dock of the Canadian Pacific at Fort William, with a storage capacity of over 800,000 tons, is one of the best equipped structures of its kind on the continent. The machinery, operated by electricity, is capable of unloading a 10,000-ton freighter in ten hours, and the coal can be transferred to cars for shipment by rail in equally fast time.

Geology

The semi-mountainous nature of the topography in the vicinity of the Twin Cities is the most striking thing noted by the visitor. Thunder cape, mount MacKay, and the series of peaks which extend westerly along the Kaministikwia

river, consist of intrusive diabase sills capping Animikie shales. This diabase is Keweenawan in age, is sometimes basaltic in structure, and dikes as well as sills are found. Silver has been mined at Silver islet near Thunder cape, also at Rabbit mountain and Silver mountain, situated 20 and 30 miles, respectively, to the west of the Twin Cities. The first geological examination of the north shore of lake Superior was made in 1846 by Sir William Logan, Director of the Geological Survey of Canada. Investigations have been carried on at intervals during later years. Since 1920, the Geological Survey of Canada has had a party in the field each year examining the area adjacent to Thunder bay.

Thirty miles east of Port Arthur, at Loon Lake on the Canadian Pacific railway, is a body of hematite ore, which forms part of the Animikie iron range. To the west of Fort William, near Kaministikwia station, magnetic iron ore occurs in Keewatin rocks. As yet no large body of ore containing over 50 per cent iron has been found. At Mokomon, west of Port Arthur, a considerable body of iron pyrites occurs. This, however, has not yet been developed.

A geological section showing the Animikie sediments and basement rocks may be seen near Kakabeka fall on the Kaministikwia River. Here, granitic gneiss dips under cherty beds at the base of the Animikie. It is in the Animikie rocks that the important Mesabi iron range of Minnesota occurs.

Native copper is found in certain Keweenawan lava flows, also in agate and calcite veinlets cutting the lava. Although the mode of occurrence is similar to that at Keweenaw point on the south shore of lake Superior, where rich copper ore occurs, no deposit of commercial importance has been found on the north or Canadian shore.

Mileage	Altitude	
128.6	**613**	**Port Arthur**
114.1	**914**	**MacKenzie**
102.0	**1048**	**Loon**
85.2	**677**	**Dorion**
63.3	**679**	**Nipigon**
55.2	**606**	**Fire Hill**
46.7	**644**	**Kama**
32.8	**619**	**Gravel**
14.3	**645**	**Rossport**
0.0	**993**	**Schreiber**
118.3		

Leaving the Twin Cities we begin the journey round lake Superior (area 32,060 square miles; altitude, 602 feet) and, for nearly 180 miles, are in close proximity to, or on, the shore of this inland sea, the largest of the Great lakes. At the southern extremity of Thunder cape is the "Sleeping Giant" or "Old-man-lying-on-his-back," the thunder of his voice being commemorated in the name of the cape.

Crossing the neck of the peninsula (summit, 1,069 feet) we follow the lake shore past Red rock, a towering bluff of red sandstone. At Nipigon we cross the Nipigon river, noted for its fishing, especially for speckled trout of remarkable size. It carries the discharge of Nipigon lake (see page 17).

99.6	**633**	**Jack Fish**
82.8	**688**	**Middleton**
74.4	**711**	**Coldwell**
55.2	**708**	**Heron Bay**
39.7	**970**	**Hemlo**
29.3	**1038**	**Trudeau**
13.1	**1148**	**Bremner**

Schreiber is a railway divisional point. From Schreiber to Heron Bay, the line either follows the lake shore or turns inland for a few miles to cross the necks of the promontories. Two miles east of Heron Bay we cross the Pic river. It was by way of this stream that the French, in 1760,

Mileage	Altitude		
0.0	1223	**White River**	made their way to the Albany river and destroyed Henley House, the only inland post of the Hudson's Bay Company.
131.8			
			White River station is a railway
111.7	1380	**Amyot**	divisional point. From White River to
102.3	1432	**Girdwood**	beyond Pardee (120 miles) the line traverses
83.3	1216	**Franz**	a lake region drained by the upper waters
78.8	1203	**Otter**	of the White, Magpie, and Michipicoten,
69.9	1175	**Lochalsh**	tributaries of lake Superior. Near Missin-
59.8	1098	**Missinaibi**	aibi the line crosses the canoe-route from
51.6	1218	**Carry**	lake Superior to James bay by way of
38.0	1375	**Bolkow**	the Michipicoten, Missinaibi, and Moose
20.1	1411	**Musk**	rivers.
14.3	1524	**Pardee**	One-half mile east of Pardee the line
0.0	1412	**Chapleau**	crosses the height-of-land between the waters of lake Superior and Hudson bay.
136.4			Chapleau, a railway divisional point, is in the Hudson Bay drainage basin. Population, about 2,500.
115.1	1421	**Nemegos**	The portion of the Hudson Bay drain-
120.6	1364	**Ridout**	age basin that is traversed by the Canadian
86.2	1439	**Woman River**	Pacific is drained by the headwaters of
70.8	1398	**Ramsay**	tributaries of the Mattagami river, the
54.4	1334	**Biscotasing**	middle branch of Moose river.
36.6	1268	**Metagama**	The line re-crosses (altitude, 1,411 feet)
19.9	1158	**Pogamasing**	to the St. Lawrence basin at mileage 78.7,
11.3	1357	**Stralak**	seven and one-half miles east of Woman
0.0	1378	**Cartier**	River station.
112.9			Many of the stations on this portion of the line bear Indian names. Nemegos means "trout" and is an abbreviation of Nemegosenda, name of the river which crosses the line at this point. Biscotasing means a "narrows (between two lakes) filled with water lilies"; Metagama is a "lake-expansion of a river"; Pogamasing is a "shallow, gravelly rapid."
106.0	1233	**Windy Lake**	Cartier is a railway. divisional point.
102.5	1090	**Levack**	Beyond Cartier the line descends 521 feet
96.2	886	**Larchwood**	to Sudbury. Near Larchwood we enter
91.3	889	**Chelmsford**	an area of excellent farming country under-
88.3	893	**Azilda**	lain by argillaceous sandstones of Lower
82.4	1002	**Murray**	Cambrian (?) age.
79.0	857	**Sudbury**	At Murray we cross a greenstone ridge. The plant and mines of the British America Nickel Corporation are close to the track. Descending from the Murray Mine ridge to Sudbury, we see, near at hand, the branch railways to nickel mines in the vicinity and, in the distance, the smoke of smelters marks the industry that has made Sudbury famous.

SUDBURY

The Sudbury area is the world's greatest producer of nickel and is also an important producer of copper.

While nickel had been long used both in the free state and in alloys, it was only after attention was pointedly drawn in 1889 to the valuable qualities that the metal gives to steel when a small percentage of it is alloyed with the latter, that it became of major importance.

The uses of nickel are growing constantly, and a large proportion of the world's production is consumed in nickel steel of various kinds. This steel is employed where increased strength, or lightness without sacrifice of strength, is required.

The beginning of the development of the Sudbury nickel-copper deposits almost synchronized with the proving of the value of nickel steel. The first deposit was discovered during the building of the Canadian Pacific railway in 1883. During the two or three years following other discoveries were made. Serious mining began in 1886 on a deposit which was rich in copper, the presence of nickel in the ore not being detected by the chemists until 1887. On the one hand, the working of these vast deposits has made possible the production of nickel steel in much greater quantity than otherwise would have been the case. On the other hand, were it not for the use of nickel in steel the deposits would be worked only on a comparatively small scale.

About ninety per cent of the world's output of nickel comes from the Sudbury area, and there are no known deposits elsewhere which can compare with those of this area, either as regards size or in the cost of producing the metal. The Sudbury deposits are so large that, in so far, at least, as this generation and the succeeding generation are concerned, they may be said to be inexhaustible.

The total production of nickel from the mines of Sudbury from 1889 to the end of 1923 was approximately 474,096 tons of 2,000 pounds. The statistics for copper from the area cover a longer period, 1886 to the end of 1922, during which time approximately 259,890 tons of the metal were produced. In the Sudbury ores the two metals are always associated, and the statistics show that nickel occurs in about twice the quantity that copper does. While this proportion of the two metals holds for the ores of the area as a whole, there is considerable difference in the ores of certain mines, nickel in some cases being in a higher proportion and in others lower. Platinum, palladium, and related metals form interesting and valuable by-products of the Sudbury ores, but the statistics as regards these metals are incomplete.

The three companies operating in the Sudbury area are, in order of seniority, the International Nickel Company with offices at Copper Cliff; the Mond Nickel Company at Coniston, and the British America Nickel Corporation at Nickelton. Each of these companies has modern and up-to-date plants, both as regards mining and smelting. The ores, which consist essentially of pyrrhotite and copper pyrites, are reduced to a matte containing approximately 80 per cent of the metals, nickel and copper. The International Nickel Company refines its matte at Port Colborne, Ont., not far from Niagara Falls, with the exception of that which is used in the production of monel metal at Huntington, W. Virginia, where malleable nickel is also fabricated. The refinery of the Mond Company is at Clydach, near Swansea, in Wales. The company is also interested in plants in Birmingham and at Clearfield, Penna. for the manufacture of nickel goods.

The matte of the British America Corporation is refined at Deschenes, Que., not far from Ottawa, Ont.

Each company has its own refining process. These processes differ greatly, one from another. While the International Nickel Company produces electrolytic nickel, most of this metal is obtained from the matte by means of the well-known Orford process, a smelting one. The Mond process of refining is one of the most unique in metallurgy, the nickel being extracted from the roasted matte, in a state of fine division, by carbon monoxide gas. The British America Corporation's refining process is an electrolytic one known as the Hybinette. Descriptions of all three of these refining processes are to be found in various publications which can be consulted for details.

From the early years of mining in the area, the mode of occurrence and distribution of the Sudbury nickel-copper deposits have attracted much attention and have been the subject of animated discussions. A large body of literature is available for anyone who desires information respecting the area.

Briefly, it may be said that most of the deposits occur on the outer, or lower, edge of what is usually described as a laccolithic sheet that forms a synclinal basin. The sheet consists of norite on its lower side passing into micropegmatite on the upper. It surrounds an area of sedimentary rocks, dipping at angles of 30° and upward toward or under the sediments. At some points the dip is practically vertical. The sheet is 36 miles long and 17 miles broad, with a thickness varying from half a mile to two miles and averaging a mile and a quarter.

The shapes of the commercial ore bodies are for the most part rudely lenticular, the Creighton, Murray, Garson, Levack and numerous other deposits having this form. Others, like the Victoria and Copper Cliff, have the form of irregular cylinders or tubes. The ores may be described as being more or less "rocky," the pyrrhotite and chalcopyrite surrounding numerous fragments of rock of various sizes, from microscopic specks up to great blocks 5, 10, 15 or more feet in diameter. Ten to sixty per cent of rock is hand-picked from the ore, giving a product which still contains 14 to 35 per cent of silica. With the pyrrhotite and chalcopyrite occurs pentlandite, which is the nickel-bearing mineral.

As illustrating the size of these ore bodies, it may be said that the Creighton has an average dip of 45°, and a maximum length of 1,000 feet, with a width at the surface of about 180 feet. The hand-picked ore, as shown by analyses made some years ago, averages 4.44 per cent of nickel and 1.56 of copper. The ore in the mine to a depth of less than 2,000 feet was determined to be 10,000,000 tons.

Outside of the Sudbury area, the silver mines of Cobalt are the only producers of nickel in the Province. But much of the nickel present in these complex ores is not saved in refining the silver and other constituents. The Alexo mine, to the east of the Porcupine area, was a small producer of nickel ore for some years but is now dormant. An interesting occurrence of nickel ore is that of Lake Shebandowan, west of Port Arthur, which awaits development.

The great variety of uses to which nickel and its alloys are now put is of interest as illustrating the advance that has been made in knowledge of the qualities of metals and alloys during a few decades.

When work began on the Sudbury deposits, less than forty years ago, the world's consumption of nickel amounted to only about 1,000 tons a year. Now it is over thirty times as great, and the uses have increased in even a greater proportion.

Mileage	Altitude	
121.7	846	**Romford**
107.3	730	**Burwash**
95.9	655	**Delamere**
83.4	630	**French River**
79.4	650	**Pickerel**
68.2	608	**Still River**
62.1	625	**Byng Inlet**
48.5	643	**Pointe au Baril**
23.1	686	**Parry Sound**
10.4	797	**Brignall**
0.0	790	**MacTier**
126.9		

At Romford junction the line to Toronto diverges from the line to Montreal and turns southward. Just eastward of Romford and in the angle between the lines to Montreal and to Toronto, is the Coniston smelter of the Mond Nickel Company. Thence, the line descends 227 feet to the crossing of the French river. This stream carries the discharge of lake Nipissing (see page 7). The Maganetawan river is crossed one mile north of Byng Inlet. At Parry Sound the line is close to the shore of Georgian bay and crosses the Seguin river on a bridge 86 feet high and one-third of a mile long.

MacTier is a railway divisional point. Twelve miles south of it is Bala, the gateway to the Muskoka lakes—Muskoka (739 feet), Joseph (742 feet), and Rosseau (742 feet).

114.9	754	**Bala**
103.8	687	**Severn Falls**
95.2	592	**Lovering**
87.1	681	**Eady**
67.2	764	**Midhurst**
58.9	717	**Essa**
45.1	727	**Alliston**
35.4	837	**Tottenham**
21.6	848	**Bolton**
11.8	554	**Woodbridge**
0.0	393	**West Toronto**
4.7	254	**Toronto**

South of the Severn river the character of the country changes and we enter a prosperous farming country. South of Lovering, the country is underlain by Black River and Trenton limestones which continue to Essa. From Essa to a point about four miles north of Baxter, it is underlain by Utica shales and from the latter to Toronto by the Lorraine (Dundas) formation.

Four miles south of Palgrave, the line crosses the watershed between the waters of lakes Huron and Ontario at an elevation of 942 feet—the highest point on the line between Sudbury and Toronto. Beyond Bolton, it descends 574 feet in 26 miles, to the starting-point of the excursion, the Union station at Toronto.

MEMORANDA

MEMORANDA